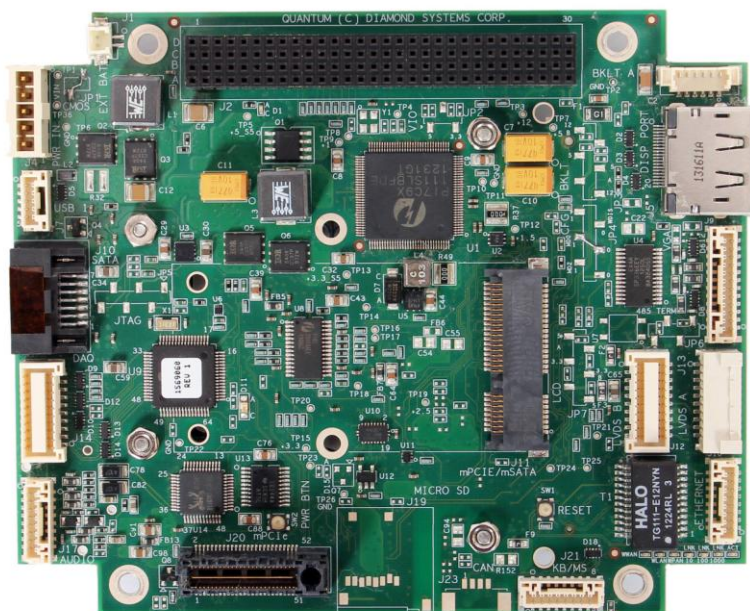




PCI/104-Express QSeven™ BASED SINGLE BOARD COMPUTER

PCI/104-Express SBC with AMD Fusion G-T40E
and Integrated Data Acquisition

Rev A: July 2014



Revision	Date	Comment
A	07/16/2014	Initial Release

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1. IMPORTANT SAFE HANDLING INFORMATION



WARNING!

ESD-Sensitive Electronic Equipment

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

Safe Handling Precautions

The Quantum SBC contains a high number of I/O connectors with connection to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond Systems (or any vendor's) embedded computer boards.

ESD damage – This type of damage is usually almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board eventually simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced.

To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

Damage during handling or storage – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond Systems recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

Power supply wired backwards – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply (i.e. almost all ICs). In this case the board will most likely be irreparable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

Board not installed properly in PC/104 stack – A common error is to install a PC/104 board accidentally shifted by 1 row or 1 column. If the board is installed incorrectly, it is possible for power and ground signals on the bus to make contact with the wrong pins on the board, which can damage the board. For example, this can damage components attached to the data bus, because it puts the $\pm 12V$ power supply lines directly on data bus lines.

Overvoltage on analog input – If a voltage applied to an analog input exceeds the design specification of the board, the input multiplexor and/or parts behind it can be damaged. Most of our boards will withstand an erroneous connection of up to $\pm 35\text{V}$ on the analog inputs, even when the board is powered off, but not all boards, and not in all conditions.

Overvoltage on analog output – If an analog output is accidentally connected to another output signal or a power supply voltage, the output can be damaged. On most of our boards, a short circuit to ground on an analog output will not cause trouble.

Overvoltage on digital I/O line – If a digital I/O signal is connected to a voltage above the maximum specified voltage, the digital circuitry can be damaged. On most of our boards the acceptable range of voltages connected to digital I/O signals is 0-5V, and they can withstand about 0.5V beyond that (-0.5 to 5.5V) before being damaged. However logic signals at 12V and even 24V are common, and if one of these is connected to a 5V logic chip, the chip will be damaged, and the damage could even extend past that chip to others in the circuit.

Bent connector pins – This type of problem is often only a cosmetic issue and is easily fixed by bending the pins back to their proper shape one at a time with needle-nose pliers. The most common cause of bent connector pins is when a PC/104 board is pulled off the stack by rocking it back and forth left to right, from one end of the connector to the other. As the board is rocked back and forth it pulls out suddenly, and the pins at the end get bent significantly. The same situation can occur when pulling a ribbon cable off of a pin header. If the pins are bent too severely, bending them back can cause them to weaken unacceptably or even break, and the connector must be replaced.

2. INTRODUCTION

The Quantum SBC family integrates a QSeven™ CPU computer-on-module (COM) plus a full analog and digital data acquisition circuit into a PCI/104-Express small form factor single board computer (SBC). It is available in the following model:

<i>Model</i>	<i>CPU</i>	<i>Processor Speed</i>	<i>Memory</i>	<i>Operating Temperature</i>
QUA-GT40E-2GE	AMD G-T40E	1.0GHz	2GB	-20°C to +71°C

The SBC includes the following key system and data acquisition features:

Processor and Memory

- 1GHz AMD Fusion G-T40E processor
- 2GB 1,333MHz 64-bit DDR3L SDRAM system memory
- 4GB MLC flash memory (on most models)
- AMI PnP Flash BIOS (AMD models only)

Video Features

- Integrated AMD Radeon HD 6250 Graphics Chipset
- Display port with resolution up to 1920 x 1080
- 18/24-bit LVDS LCD interface with resolution up to 1920 x 1080 supports dual independent displays
- VGA CRT with resolution up to 1920 x 1080

Ethernet

- 10/100/1000Mbps Ethernet circuit integrated in the QSeven™ CPU Module using Realtek RTL8111E PCIe Gigabit Ethernet controller
- On-board transformer and termination network for direct connection to Ethernet cabling

Standard Peripheral Interfaces

- 3 16550-compatible RS-232 ports (2 have RS-422/485 capability)
- 5 USB 2.0 ports
- PS/2 keyboard and mouse ports

The BIOS supports a USB keyboard during BIOS initialization, and it also supports legacy keyboard emulation via USB for DOS. The USB ports can be used for keyboard and mouse at the same time that the PS/2 keyboard and mouse are connected.

- HD Audio Codec from Realtek ALC262

Mass Storage

- 1 x Serial ATA port w/ 600MB/s HDD transfer rate on standard SATA connector
- 1 x Serial ATA ports w/ 600MB/s HDD transfer rate on PCIe MiniCard socket

Analog I/O

- 4 single-ended channels, 12-bit resolution
- 0-3.3V input ranges
- Unipolar input ranges

Digital I/O

- Up to 10 programmable digital I/O lines
- Enhanced output current capability: +24mA maximum

PWM

- Up to 4 programmable PWM output lines
- Enhanced output current capability: +24mA maximum

Bus Interfaces

- PCI-104 stackable I/O
- PCIe/104 stackable I/O
- 1 PCIe MiniCard socket

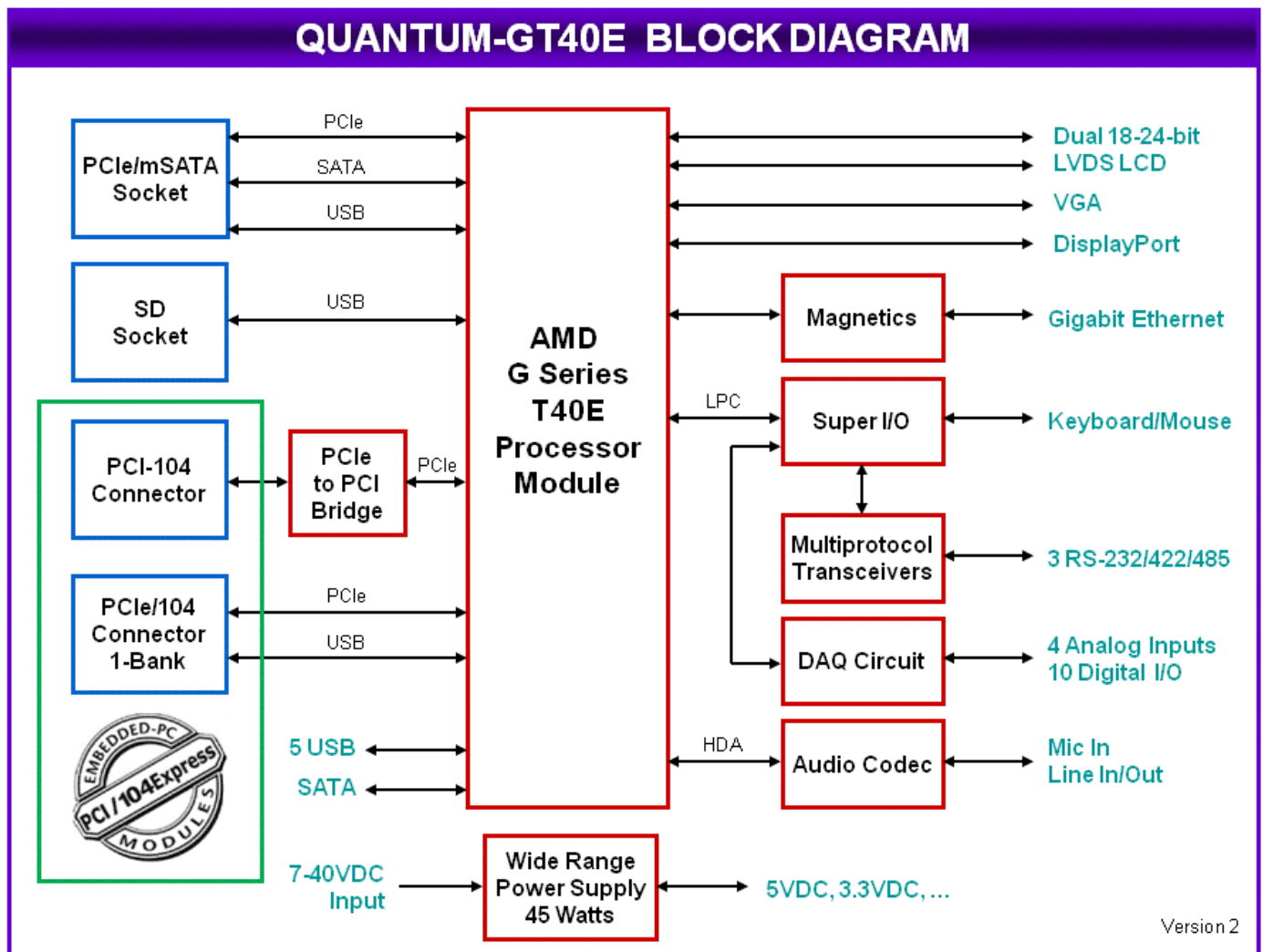
Battery Backup

Quantum contains a backup battery for the real-time clock and BIOS settings. The battery is directly soldered to the board and provides a minimum 7 year backup lifetime at 25°C. For longer lifetime an external battery of 3.3V +/-10% may be attached to the board.

Power Supply

Quantum uses a wide-range input DC/DC power supply. This circuit accepts input voltages in the range of +6-32VDC and produces 5.0VDC +2/-0% over the full range of its expected load (7A maximum). The input power connector provides connections for provision of +12V for LCD backlight, cooling fan, and PCI-104 connector.

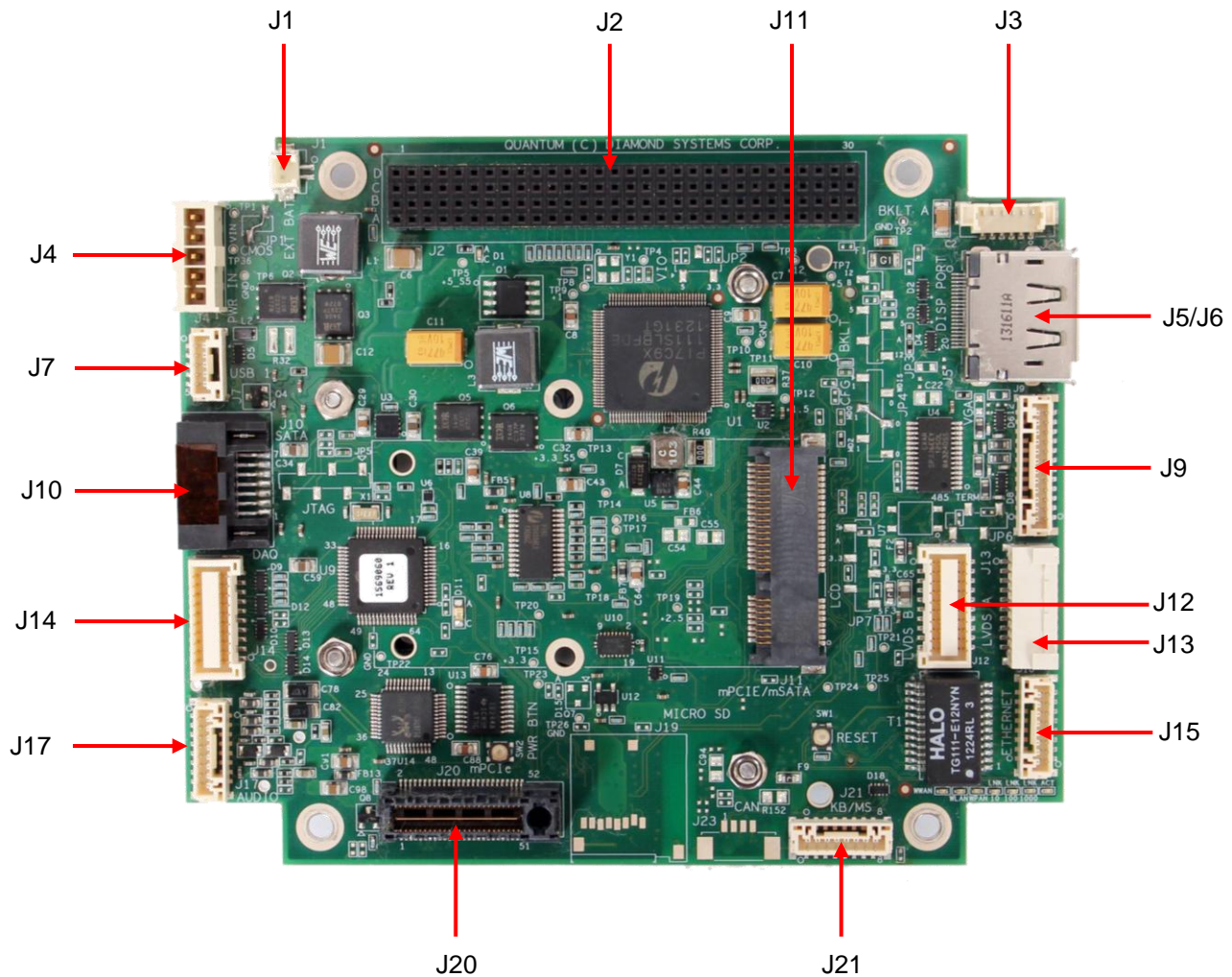
3. FUNCTIONAL BLOCK DIAGRAM



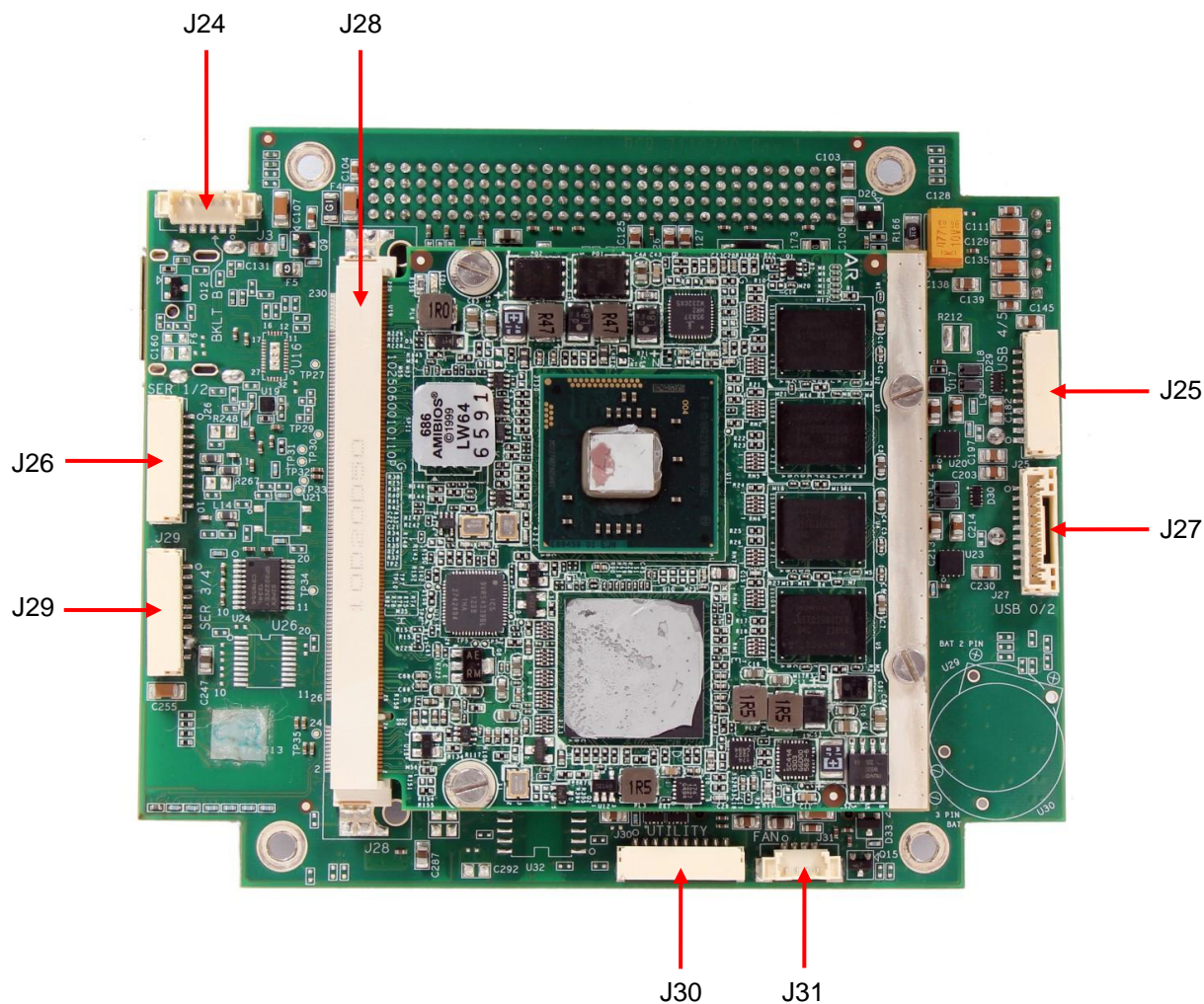
Functional Block Diagram

4. BOARD DIAGRAM

The diagram below shows the board layout, including connectors and mounting holes.



Quantum SBC Connector Location -- Top View



Quantum SBC Connector Location -- Bottom View with QSeven COM Attached

5. CONNECTOR AND JUMPER LISTS

5.1 I/O Connectors

Connector	Function
J1	External battery
J2	PCI bus
J3	LCD backlight A
J4	Input power
J5	Display port
J6	HDMI port
J7	USB1 host/client port
J9	VGA
J10	SATA
J11	PCIe MiniCard / mSATA
J12	LCD interface channel B (LVDS format)
J13	LCD interface channel A (LVDS format)
J14	Data acquisition I/O
J15	Ethernet
J17	Audio
J20	PCIe/104 (Port 2 and Port 3)
J21	PS/2 keyboard & mouse
J24	LCD backlight B
J25	USB 4/5
J26	Serial COM ports 1/2
J27	USB 0/2
J28	QSeven computer-on-module
J29	Serial COM port 3
J30	Utility
J31	Fan

5.2 Configuration Jumpers

Jumper	Description
JP1	Battery
JP2	PCI/104 VIN voltage configuration
JP3	LVDS display backlight voltage selection
JP4	COM 1/2 RS-422/485 configuration
JP6	COM1/2 RS-422/485 termination
JP7	LCD supply channel A & B

6. I/O CONNECTORS

Note: Pins marked as “key” are cut away or removed.

6.1 External Battery (J1)

Connector J1 is used to connect an optional external battery to replace the on-board backup battery. The on-board battery provides about 7 years of lifetime at an ambient temperature of 25°C. For longer lifetime an external battery of 3.3V \pm 10% may be connected to this connector. Diamond Systems’ cable part number 6980511 mates with this connector.

1	Battery+
2	Ground

Connector type: Standard .1” single row straight friction lock pin header

Connector: DF13C-2P-1.25V

6.2 PCI Bus (J2)

The PCI bus connector is a solder-pin non-stack through (short pin) connector installed on the top side. Expansion modules may be mounted only on the top side of the board due to the presence of the QSeven module on the bottom side.

Pin	A	B	C	D
1	GND/5.0V KEY ²	Reserved	+5V	AD0
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0*	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V	C/BE1*	AD15	+3.3V
9	SERR*	GND	SB0*	PAR
10	GND	PERR*	+3.3V	PME#
11	STOP*	+3.3V	LOCK*	GND
12	+3.3V	TRDY*	GND	DEVSEL#
13	FRAME*	GND	IRDY*	+3.3V
14	GND	AD16	+3.3V	CBE2#
15	AD18	+3.3V	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V	AD23	AD22	+3.3V
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3*	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0*	GND	REQ1*	VI/O
24	GND	REQ2*	+5V	GNT0*
25	GNT1*	VI/O	GNT2*	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	INTD*	+5V	RST*
29	+12V	INTA*	INTB*	INTC*
30	-12V	Reserved	Reserved	GND

Connector: PCI-104 non-stack-through with solder pins; bottom side shroud and shroud mounting holes not required

Mating connector: Any PCI-104 stack-through connector

6.3 Input Power (J4)

Quantum SBCs accept a wide-range input DC/DC power supply. This circuit accepts input voltages in the range of +6-32VDC. All other required voltages are generated on board. Each pin is rated at 3A max. Diamond Systems' cable part number 6980510 mates with this connector.

Additional 12V power rails required by for LCD backlight, cooling fan, and PCI-104 connector (if needed) is provided on connector J4.

1	+6-34VDC
2	+6-34VDC
3	Ground
4	Ground
5	+12V In

Connector type: Standard .1" single row, 5 positions, straight pin header with gold flash plating

Connector: IPL1-105-01-L-S-K

6.4 Display Port (J5)

The Quantum SBC provides a standard display port on connector J5. The resolution of the display port output matches the resolution configured in the display port. An attached monitor should be able to automatically adapt for many of the available resolutions.

Display Port Connector J5

Lane 0+	1	2	Ground
Lane 0-	3	4	Lane 1+
Ground	5	6	Lane 1-
Lane 2+	7	8	Ground
Lane 2-	9	10	Lane 3+
Ground	11	12	Lane 3-
Ground	13	14	Ground
Aux+	15	16	Ground
Aux-	17	18	Hot Plug Detect
Power return	19	20	3.3V

Signal Name	Definition
Lane 0+/- to Lane 3+/-	Main link
Ground	Ground return
AUX +/-	Auxiliary channel
Hot Plug Detect	Hot Plug Detect
3.3V	Power

Connector type: Standard Display Port connector, PC mount right angle

6.5 HDMI (J6)

Freescale A9 i.MX6 Quantum SBC models provide a standard HDMI on connector J6. The resolution of the HDMI output matches the resolution configured in the HDMI monitor. An attached monitor should be able to automatically adapt for many of the available resolutions.

HDMI connector J6

Data 2+	1	2	Ground
Data 2-	3	4	Data 1+
Ground	5	6	Data 1-
Data 0+	7	8	Ground
Data 0-	9	10	Clock+
Ground	11	12	Clock-
CEC (NC)	13	14	Reserved
DDC Clock	15	16	DDC Data
Ground	17	18	+5V
Hot Plug Detect	19		

Signal Name	Definition
Data 0+/- to Data 3+/-	TDMS data pair
Ground	Ground return
Clock +/-	TDMS data pair
DDC-CLOCK/DATA	Signals used for monitor detection (DDC1 specification)
Hot Plug Detect	Hot Plug Detect
+5V	Power

Connector type: Standard HDMI type A connector, PC mount right angle

6.6 VGA (J9)

Connector J9 is used to connect a VGA monitor. Although the DDC serial detection pins are present, a 5V power supply is not provided, and the legacy "Monitor ID" pins are also not used. Diamond Systems' cable part number 6980507 mates with this connector.

RED	1
Ground	2
GREEN	3
Ground	4
BLUE	5
Ground	6
HSYNC	7
VSYNC	8
Ground	9
DDC-Data	10
DDC-Clock	11
Ground	12

Signal Name	Definition
RED	RED signal (positive, 0.7Vpp into 75 Ohm load)
Ground	Ground return for RED, GREEN, and BLUE signals
GREEN	GREEN signal (positive, 0.7Vpp into 75 Ohm load)
BLUE	BLUE signal (positive, 0.7Vpp into 75 Ohm load)
DDC-CLOCK/DATA	Signals used for monitor detection (DDC1 specification)

Connector type: Standard 2mm single row straight pin header with gold flash plating.

Connector: JST BM12B-GHS-TBT 1x12 vertical SMT

6.7 SATA (J10)

This connector avails the SATA connection on the carrier boards.

1	Ground
2	SATA 1 TX+
3	SATA 1 TX-
4	Ground
5	SATA 1 RX-
6	SATA 1 RX+
7	Ground

Connector type: Standard 7-pin SATA connector, right angle

Connector: Molex 470804005

6.8 mSATA / PCIe MiniCard (J11)

This socket can be configured for either PCIe MiniCard or mSATA disk module use. The configuration is done with 0 ohm resistors where a conflict occurs between the two configurations as shown in bold.

PCle MiniCard mSATA mSATA / PCIe MiniCard

		1	2	+3.3V
		3	4	Gnd
		5	6	+1.5V
		7	8	
Clkreq-		9	10	
Gnd	Gnd	11	12	
PCle Clk-	PCle 1 Clk-	13	14	
PCle Clk+	PCle 1 Clk+	15	16	
Gnd	Gnd	KEY		
		17	18	Gnd
		19	20	W_Disable#
		21	22	PCle Reset#-
		23	24	+3.3V
PCle 0 RX-	SATA 1 RX-	25	26	Gnd
PCle 0RX+	SATA 1 RX+	27	28	+1.5V
Gnd	Gnd	29	30	SMB Clk
Gnd	Gnd	31	32	SMB Data
PCle 0 TX-	SATA 1 TX-	33	34	Gnd
PCle 0 TX+	SATA 1 TX+	35	36	USB 4-
Gnd	Gnd	37	38	USB 4+
Gnd	Gnd	39	40	Gnd
+3.3V	+3.3V	41	42	WWAN LED#-
+3.3V	+3.3V	43	44	WLAN LED#
Ground	Ground	45	46	WPAN LED#
		47	48	+1.5V
		49	50	Gnd
Pull-up to +3.3V	Pull-up to +3.3V	51	52	+3.3V

Note: For mSATA mode, the PCIe clock signal is not active because CLKREQ- pin is not driven low by the module.

Connector: JAE MM60-52B1-E1-R650 mSATA / PCIe MiniCard socket

JAE NT4R1600 3.55mm high M2 x 0.4 threaded mounting spacers qty 2 built into baseboard for full-size module

6.9 LVDS LCD Interface (J12, J13)

Connector J13 is used to connect LVDS LCD Channel A. Connector J12 is used to connect LVDS LCD Channel B. Voltage selection for LCD can be configured on JP7. If needed, the LCD backlight can be connected to connector JP3. Diamond Systems' cable part number 6981211 mates with these connectors for LCD connection.

J13, LCD Channel A

A3+	1	2	A2+
A3-	3	4	A2-
Signal Ground	5	6	Signal Ground
A1+	7	8	A0+
A1-	9	10	A0-
Signal Ground	11	12	Signal Ground
Channel A Clk+	13	14	Vcc 3.3V / 5V (jumper configured)
Channel A Clk-	15	16	Vcc 3.3V / 5V (jumper configured)
Signal Ground	17	18	Signal Ground
DID_DAT	19	20	DID_CLK

J12, LCD Channel B

B3+	1	2	B2+
B3-	3	4	B2-
Signal Ground	5	6	Signal Ground
B1+	7	8	B0+
B1-	9	10	B0-
Signal Ground	11	12	Signal Ground
Channel A Clk+	13	14	Vcc 3.3V / 5V (jumper configured)
Channel A Clk-	15	16	Vcc 3.3V / 5V (jumper configured)
Signal Ground	17	18	Signal Ground
DID_DAT	19	20	DID_CLK

Connector type: Standard 2mm dual row straight pin header with gold flash plating.

Connector: Channel A: JST BM20B-GHDS-G-TF 2x10 straight 1.25mm pitch gold

Channel B: JST BM20B-GHDS-G-TF 2x10 straight 1.25mm pitch gold

Mating connector: JST GHDR-20V-S

Crimp terminal: JST SGHD-002GA-P0.2

6.10 LCD Backlight (J3, J24)

Connector J3 provides the backlight power for LCD Channel A Connector. J24 provides the backlight power for LCD Channel B and control for an optional LCD panel. Diamond Systems' cable part number 6981210 mates with this connector.

J3, LCD Backlight Channel A

1	LCD A Power
2	LCD A Power
3	Ground
4	Ground
5	Enable (GPIO output), 0 = off, open circuit = on
6	Brightness, 0-5VDC variable; 0V = max, 5V = min

J24, LCD Backlight Channel B

1	LCD B Power
2	LCD B Power
3	Ground
4	Ground
5	Enable (GPIO output), 0 = off, open circuit = on
6	Brightness, 0-5VDC variable; 0V = max, 5V = min

The LCD power is jumper selectable for +5V or +12V. See the description for JP3.

The enable signal controls power to the backlight. It is controlled by digital I/O signal.

Connector Part Numbers: Molex 53398-0671

6.11 Data Acquisition (J14)

Connector J14 provides 10 digital I/O lines from PIC controller. These lines have ESD protection to protect the SBC from potential damage. The connector also provides four analog input channels and four pulse width modulator outputs. Diamond Systems' cable part number 6980501 mates with this connector.

DIO 0	1	2	DIO 1
DIO 2	3	4	DIO 3
DIO 4	5	6	DIO 5
DIO 6	7	8	DIO 7
DIO 8	9	10	DIO 9
PWM 1A	11	12	PWM 1B
PWM 1C	13	14	PWM 1D
Ground	15	16	Agnd
AN0	17	18	AN1
AN2	19	20	AN3

Signal	Definition
DIO 0-9	Digital I/Os
PWM 1A:1D	PWM outs
AN 0:3	Analog inputs
Ground	Digital ground
Agnd	Analog ground

Connector type: Standard 2mm dual row straight pin header with gold flash plating

Connector: JST BM20B-GHDS-G-TF 2x10 straight 1.25mm pitch gold

6.12 Ethernet (J15)

The 10/100/1000 Base-T, full-duplex Ethernet interface is provided by connector J15. Diamond Systems' cable part number 6980502 mates with this connector.

MX1+	1
MX1-	2
MX2+	3
MX2-	4
MX3+	5
MX3-	6
MX4+	7
MX4-	8
NC	9
Ground	10

Signal	Definition
TX+, TX-	Transmit data from Q7 connector
RX+, RX-	Receive data by Q7 connector
Ground	System ground

Connector type: Standard 2mm single row straight pin header with gold flash plating

Connector: JST BM10B-GHS-TBT 1x10 vertical SMT

6.13 Audio (J17)

Quantum provides an HDA audio circuit based on the Realtek ALC262 audio chip. The circuit offers stereo line in, stereo line out, and mono mic in connections. Diamond Systems' cable part number 6980508 provides the 3.5 mm output and input jacks for Lineout, Mic and Line in connection.

1	LineOut – L
2	LineOut – R
3	GND_Audio
4	LineIn – L
5	LineIn – R
6	GND_Audio
7	MIC IN
8	GND_Audio

Connector: JST BM08B-GHS-TBT 1x8 vertical SMT

6.14 PCIe/104 (J20)

The PCIe/104 (J20) connector is a 1-bank version of the PCIe/104 connector, providing only the first bank of pins numbered 1-52. It offers up to two PCIe x1 lanes from ports 2 and 3 of the QSeven module (third and fourth lanes) plus up to two USB ports from ports 6 and 7 of the QSeven module (seventh and eighth ports). It also provides connections for SMB signals from the QSeven module.

PCIe/104 Specification	Carrier	Carrier		PCIe/104 Specification	Carrier
USB-OC-	USB-OC-	1	2	PCIe Reset-	PCIe Reset-
+3.3V	+3.3V	3	4	+3.3V	+3.3V
USB 1+	USB 7+	5	6	USB 6+	USB 0+
USB 1-	USB 7-	7	8	USB 6-	USB 0-
Gnd	Gnd	9	10	Gnd	Gnd
PCIe 1 T+	PCIe 3 T+	11	12	PCIe 2 T+	PCIe 0 T+
PCIe 1 T-	PCIe 3 T-	13	14	PCIe 2 T-	PCIe 0 T-
Gnd	Gnd	15	16	Gnd	Gnd
PCIe 2 T+		17	18		PCIe 3 T+
PCIe 2 T-		19	20		PCIe 3 T-
Gnd	Gnd	21	22	Gnd	Gnd
PCIe 1 R+	PCIe 3 R+	23	24	PCIe 2 R+	PCIe 0 R+
PCIe 1 R-	PCIe 3 R-	25	26	PCIe 2 R-	PCIe 0 R-
Gnd	Gnd	27	28	Gnd	Gnd
PCIe 2 R+		29	30		PCIe 3 R+
PCIe 2 R-		31	32		PCIe 3 R-
Gnd	Gnd	33	34	Gnd	Gnd
PCIe 1 Clk+	PCIe 3 Clk+	35	36	PCIe 2 Clk+	PCIe 0 Clk+
PCIe 1 Clk-	PCIe 3 Clk-	37	38	PCIe 2 Clk-	PCIe 0 Clk-
+5V_STBY	+5V_STBY	39	40	+5V_STBY	+5V_STBY
PCIe 2 Clk+		41	42		PCIe 3 Clk+
PCIe 2 Clk-		43	44		PCIe 3 Clk-
Dir	Dir	45	46	PU to 3.3V	Pwr Good
SMB Data	SMB Data	47	48		PCIe x16 Clk+
SMB Clk	SMB Clk	49	50		PCIe x16 Clk-
SMB Alert-	SMB Alert-	51	52		PS0N-

Connector: Samtec ASP-129637-08 QMS series 15.24mm stacking height single bank

Mating connector: Samtec ASP-129646-18 QFS series 15.24mm stacking height single bank or ASP-129646-03 QFS series 15.24mm stacking height 3-bank connector

6.15 PS/2 Mouse and Keyboard (J21)

Connector J21 provides the standard PS/2 keyboard and mouse signals. Diamond Systems' cable part number 6980506 mates with this connector and provides standard connections for PS/2 keyboard and mouse.

+5V	1
KB Data	2
KB Clk	3
Ground	4
+5V	5
MS Data	6
MS Clk	7
Ground	8

Signal	Definition
+5V	System +5V power
KB Data	Keyboard data
KB Clk	Keyboard clock
MS Data	Mouse data
MS Clk	Mouse clock
Ground	System ground
Key	Key pin (missing on pin header, plugged on mating cable)

Connector type: Standard 2mm single row right angled pin header with gold flash plating

6.16 USB Host/Client Port (J7)

Quantum features one USB Host / Client port on connector J7. Port 1 may be a client port on some of the Q7 modules. J7 interfaces to USB port 1. USB 2.0 provides a 480Mbps maximum data transfer rate. The shield pin on each connector is tied to system ground. Diamond Systems' cable part number 6980504 mates with these connectors for Host. Diamond Systems' cable part number 6980505 mates with these connectors for Client.

1	USB0 Power
2	USB0 Data-
3	USB0 Data+
4	Ground
5	Device ID

Connector: JST BM05B-GHS-TBT 1x5 vertical SMT (ports 1), top side of PCB

Mating connector: JST GHR-5V-S

6.17 USB (J25, J27)

Quantum features four USB 2.0 ports on 2 pin headers. Connector J25 interfaces to USB port 4/5 and connector J27 interfaces to USB ports 0/2. USB 2.0 provides a 480Mbps maximum data transfer rate. The shield pin on each connector is tied to system ground. Diamond Systems' cable number 6980503 mates with these connectors.

J27, USB ports 0 and 2

USB0 Pwr	1
USB0 Data-	2
USB0 Data+	3
Ground	4
Shield	5
USB2 Pwr	6
USB2 Data-	7
USB2 Data+	8
Ground	9
Shield	10

J25, USB ports 4 and 5

USB4 Pwr	1
USB4 Data+	2
USB4 Data-	3
Ground	4
Shield	5
USB5 Pwr	6
USB5 Data+	7
USB5 Data-	8
Ground	9
Shield	10

Connector type: Standard 2mm single row right angled pin header with gold flash plating

Connector: JST SM10 B-GHS-TBT 1x10 right angled SMT

6.18 Serial Ports (J26, J29)

There are two serial port connectors with identical pin outs. Ports 1-2 are on J26 connector and port 3 is on the bottom side right angled J29 connector. RS-422 and RS-485 pin outs apply only to ports 1 and 2. Diamond Systems' cable number 6980500 provides two DB9 connectors.

Pin	RS-232	RS-422	RS-485
1	TX1	TX1+	TX/RX 1+
2	RTS1	TX1-	TX/RX 1-
3	RX1	RX1+	NC
4	CTS1	RX1-	NC
5	Ground	Ground	Ground
6	TX2	TX2+	TX/RX 2+
7	RTS2	TX2-	TX/RX 2-
8	RX2	RX2+	NC
9	CTS2	RX2-	NC
10	Ground	Ground	Ground

Port 3 only provides RS-232 protocol. Ports 1 and 2 also provide RS-422/485 capability.

Connector: JST SM10B-GHS-TB 1x10 right angle SMT, located on bottom side of PCB

6.19 Utility Connector (J30)

The pin out of the utility connector is shown below along with the corresponding QSeven module connector pin. Diamond Systems' cable number 6980509 mates with these connectors.

QSeven Pin	Signal			Signal	QSeven Pin
	Gnd	1	2	Reset-	28
20	Pwr Switch-	3	4	WDT Trigger-	70
21	Sleep-	5	6	Battery Low-	27
13	GBE Link-	7	8	GBE Link100-	7
8	GBE Link1000-	9	10	+3.3V (fused)	

Connector: 2mm pitch 2x5 vertical pin header, 4mm posts, gold plating

Mating connector: 2mm pitch 2x5 IDC or crimp terminal socket

6.20 Fan Connector (J31)

The pin out of the fan connector is shown below. The fan is powered by +5VDC.

PWMOUT	1
Tacho_In	2
Power 5V	3
Ground	4

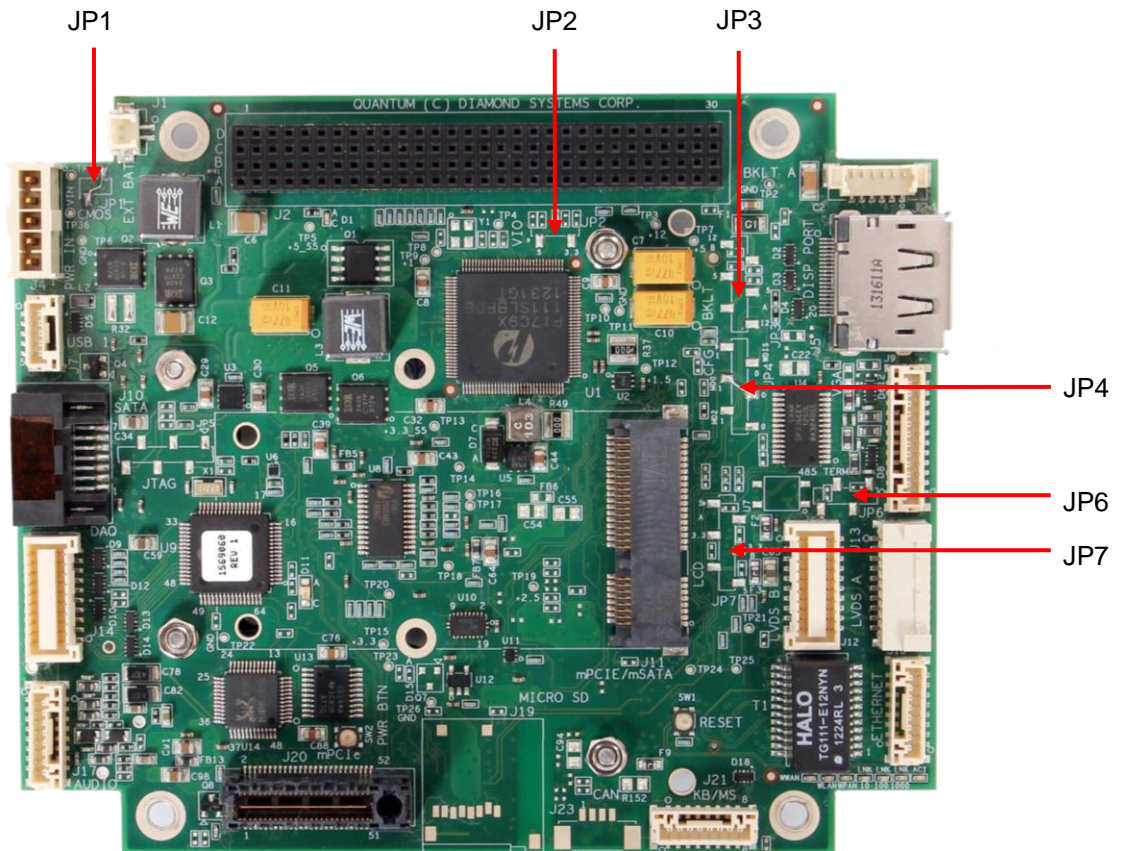
Connector: Molex 0532610471

Connector type: Standard .1" single row straight pin header with gold flash plating

7. CONFIGURATION JUMPERS

The Quantum SBC contains the following configuration jumper blocks. The diagram below shows the default jumper settings.

<i>Jumper</i>	<i>Description</i>
JP1	Battery
JP2	PCI voltage configuration
JP3	LCD backlight power
JP4	COM 1/2 RS-232/422/485 configuration
JP6	COM 1/2 RS-422/485 termination configuration
JP7	LCD supply channel A & B



7.1 Battery configuration (JP1)

Jumper block JP1 configures the battery voltage supply.

Battery Jumper JP1

VBAT_IN	1
VCC_RTC	2

<i>Pins 1-2</i>	<i>Function</i>
Jumper	VIO_RTC = 3V
No jumper	VCC_RTC = 0V

7.2 PCI voltage configuration (JP2)

Jumper block JP2 configures the voltage supply for PCI/104 add on modules.

VIO_PCI Jumper JP2

5V	1
VIO_PCI	2
3.3V	3

<i>JP2</i>	<i>Function</i>
1-2	VIO_PCI = 5V
2-3	VIO_PCI = 3.3V

7.3 LCD Backlight Power (JP3)

Jumper block JP3 configures the voltage supply for the LCD backlight. There are labels on the board representing the jumper configurations. Available options are +5V input or +12V.

LCD Backlight Power JP3

12V	1
VLCD_BKLT A	2
5V	3
5V	4
VLCD_BKLT B	5
12V	6

<i>JP3</i>	<i>Function</i>
1-2	VLCD_BKLT A = 12V
2-3	VLCD_BKLT A = 5V (Default)
4-5	VLCD_BKLT B = 5V (Default)
5-6	VLCD_BKLT B = 12V

7.4 RS-232/422/485 Configuration (JP4)

Use JP4 to set COM1 and COM 2 in RS-232/422/485 modes.

RS-232/422/485 Jumper JP4

W_DISABLE	1
GROUND	2
MODE 0	3
GROUND	4
MODE 2	5
GROUND	6
PIC_MCLR_RESET	7
PIC_MCLR_RC	8

<i>MODE 0</i>	<i>MODE 2</i>	<i>Function</i>
3-4 jumper (Default)	5-6 Open - No jumper (Default)	RS-232 Mode (Default)
3-4 Open - No jumper	5-6 Open - No jumper	2T/2R RS-422
3-4 Open - No jumper	5-6 jumper	2T/2R RS-485 & 2R RS-232
3-4 jumper	5-6 jumper	Loop Back Mode (TX in to RX out)

7.5 RS-422/485 Termination configuration for COM1/2 (JP6)

Use JP6 to select the COM1 RS-422/485 termination and COM2 RS-422/485 termination. Any port configured for RS-232 should not have any jumpers installed.

For RS-422: Installing two jumpers in the 422 TERM positions connects a 120 ohm termination resistor across the RX + and – lines and connects 1K ohm bias resistors to the RX lines. The + line is biased toward ground, and the – line is biased toward +5V. This sets the receiver to an inactive state when the receiver is unconnected. Both jumpers should be installed if termination / biasing is desired. Installing only one jumper will create unpredictable behavior by the receiver.

For RS-485: Installing a jumper in the 485 TERM position connects a 120 ohm resistor across the differential driver/receiver pair. The RS-485 network should have a termination resistor installed at each end of the circuit but not at intermediate nodes.

RS-422/485 Termination JP6

RX1+	1
RX1-	2
RX2+	3
RX2-	4

<i>JP6</i>	<i>Function</i>
1-2 jumper	120 ohm on Port1
1-2 Open - No jumper	No Termination - Default
3-4 jumper	120 ohm on Port2
3-4 Open - No jumper	No Termination - Default

7.6 LCD Power (JP7)

Jumper block JP7 configures the voltage supply for the LCD. There are labels on the board representing the jumper configurations. Available options are +3.3V input or +5V.

LCD Power JP7

5V	1
VLCD_ A	2
3.3V	3
3.3V	4
VLCD_ B	5
5V	6

JP3	Function
1-2	VLCD_ A = 5V
2-3	VLCD_ A = 3.3 (Default)
4-5	VLCD_ B = 3.3V (Default)
5-6	VLCD_ B = 5V

8. SYSTEM RESOURCES

The table below lists the default system resources utilized by the circuits on Quantum SBC.

<i>Device</i>	<i>I/O Address</i>	<i>ISA IRQ</i>	<i>ISA DMA</i>
Serial Port COM1	0x3F8 – 0x3FF	4	–
Serial Port COM2	0x2F8 – 0x2FF	3	–
Serial Port COM3	0x3E8 – 0x3EF	10	–
Serial Port COM4	0x2E8 – 0x2EF	11	–
Ethernet	OS-dependent	OS-dependent	–
USB	OS-dependent	OS-dependent	–
Sound	OS-dependent	OS-dependent	–
Video	OS-dependent	OS-dependent	–
PC/104-Plus	OS-dependent	OS-dependent	–
PCIe/104	OS-dependent	OS-dependent	–
mini PCIe	OS-dependent	OS-dependent	–

Most of these resources are configurable and, in many cases, the operating system alters these settings. The main devices that are subject to this dynamic configuration are on-board Ethernet, sound, video, USB, and any PC/104-Plus cards, PCIe/104, and PCIe MiniCards that are in the system. These settings may also vary depending on what other devices are present in the system. For example, a Display Port on a PC/104-Plus card may change the on-board Ethernet resources.

9. VIDEO FEATURES

The Quantum SBC includes a video subsystem that provides Display Port, HDMI, CRT and 2 LVDS output with several choices of resolution. The resolution is can be changed in the BIOS.

<i>LVDS Resolution</i>	<i>CRT Auto-Adapt</i>	<i>Note</i>
640 x 480 18Bit Single	Yes	
800 x 600 18Bit Single	Yes	
1024x 600 18Bit Single		
1024 x 768 18Bit Single	Yes	Default resolution
1280 x 720 18Bit Single		
1280 x 800 18Bit Single		
1366 x 768 18Bit Single		
1440 x 900 18Bit Single		
1366 x 768 24Bit Single		
1440 x 900 24Bit Single		
1280 x 1024 24Bit Dual		
1440 x 1050 24Bit Dual		
1600 x 900 24Bit Dual		
1680 x 1050 24Bit Dual		
1600 x 1200 24Bit Dual		
1920 x 1080 24Bit Dual		

9.1 VGA CRT (J9)

The Quantum SBC provides a standard CRT port on connector J8. The resolution of the CRT output matches the resolution configured in the BIOS for the LVDS/CRT. An attached monitor should be able to automatically adapt for many of the available resolutions. If the monitor does not adapt properly, either adjust the monitor settings, change the LVDS/CRT resolution in the BIOS (see BIOS section), or use a different monitor.

Note: The BIOS setup screens and DOS display are always configured for 640x480 resolutions, regardless of the display resolution selected in the BIOS. If you configure the BIOS for a different resolution, the display may not look correct when you are in the BIOS setup screens or in DOS. For example, if the screen is set for 1024x768, the BIOS and DOS screens will appear smaller than full screen and will generally be centered in the screen with a blank border around them. If you are using DOS, the optimum CRT resolution is 640x480. This same advice may apply for a text-based Linux environment as well.

Diamond Systems cable number 6980507 is used to connect a monitor to connector J9. It provides a standard DB15 female connector for a CRT.

9.2 Display Port (J5)

The Quantum SBC provides a standard display port on connector J5. The resolution of the display port output matches the resolution configured in the display port. An attached monitor should be able to automatically adapt for many of the available resolutions.

9.3 HDMI (J6)

Quantum provides a standard HDMI on connector J6. The resolution of the HDMI output matches the resolution configured in the HDMI monitor. An attached monitor should be able to automatically adapt for many of the available resolutions.

9.4 LVDS (J12, J13)

The LCD used with the Quantum SBC must match the programmed resolution and scan rate in the BIOS. These settings can be changed in BIOS. Quantum provides 18-bit/24 bit LVDS output, so the LCD selected must work with 18-bit /24 bit data.

As opposed to CRTs, there is no standard LCD connector type or format. Each LCD manufacturer has its own standards, and there are also different specifications such as the number of data bits used in the video signal. You may need to create your own LCD cable to connect from the LCD connector on Quantum to the input connector on your LCD. For assistance with signal definitions or wiring requirements, contact the LCD maker or Diamond Systems technical support. Diamond Systems offers cable part number 6981211 with the correct connector type and pinout to match the LCD connector on the Quantum SBC. The other end may need to be changed to work with your LCD.

Connector J13 is used to connect LVDS LCD Channel A. Connector J12 is used to connect LVDS LCD Channel B. Voltage selection for LCD can be configured on JP7. If needed, the LCD backlight can be connected to connector JP3.

The backlight power is jumper-selectable between +5V and +12V using jumper block JP3. If 12VDC is needed for the LCD, it must be provided either on one of the input power connectors or on the 12V pin (J1, B9) of the PC/104 connector. Quantum does not generate 12V internally.

WARNING: Be sure the proper voltage is configured BEFORE connecting the cable to your backlight inverter, or it could be damaged.

The brightness control for the LCD backlight has a weak pull-down resistor to ensure maximum brightness when it is not connected externally.

Diamond Systems offers cable part number 6981210 with the correct connector type and pin out to match the backlight power connector on Quantum SBC. The other end may need to be changed to work with your LCD backlight inverter.

10. UPDATING THE BIOS

The BIOS image is programmed into the Quantum SBC by using the SPIFLASH utility program.

1. Create a DOS bootable mass storage device such as a USB memory stick.
2. Copy the desired BIOS image file to the boot device.
3. Install the boot device on the Quantum SBC and power it up.
4. At the DOS prompt, type the following command. <filename.bat> is the name of the BIOS image file. The filename must conform to the DOS 8-character naming convention.

```
Run <filename.bat>
```

5. SPIFLASH will automatically reprogram the SBC's BIOS image and provide a progress indicator. The program will indicate successful completion of the process, which should take about 10 seconds.
6. Restart the system and press the **DEL** key to enter the BIOS SETUP utility.
7. Hit the left arrow key once to go to the tab labeled "Exit." Select "Load optimal defaults" using the up/down arrow keys, and hit **Enter** to confirm. Then select "Save and Exit," and hit **Enter** to confirm.
8. This completes the BIOS process. Reboot the system with the LCD attached to verify proper performance.

11. INSTALLATION AND CONFIGURATION

This section describes the steps needed to get your Quantum SBC up and running, and assumes that you have the Quantum Development Kit or Quantum Cable Kit. The Cable Kit includes all cables needed for the I/O. The Development Kit includes the SBC, Cable Kit, and AC adapter to power the SBC.

11.1 Quick Setup

1. Attach VGA cable 6980507, PS/2 keyboard / mouse cable 6980508, and USB cables 6980503 as needed.
2. Attach display, keyboard, and mouse (if needed) to the cables.
3. Connect power to power input connector J4 using AC adapter **X** or your own power supply with power cable 6980510. The input connector and cable keyed to prevent incorrect connection. However ensure that the red wire +5V are on pin 1 of the board connector J4.

WARNING: Attaching the power connector incorrectly will destroy the QUANTUM SBC!

4. For a quick verification that the system is set up and working properly, if no boot device is attached, the system will boot to BIOS screen.

11.2 Boot Device Options

Quantum can boot from a SATA, mSATA, or USB device. The boot device selection and priority are configured in the BIOS **Boot** menu. See Chapter 12 for detailed BIOS instructions. Only devices which are currently attached to the SBC will appear in the list of options. Therefore if you want to select a hard drive or USB device as the boot device, you must connect it to the SBC first, then boot up and enter the BIOS, then select it as a boot device.

The following are a few example boot scenarios.

- ◆ Install an SATA hard disk directly on the SATA connector.
- ◆ Attach a bootable USB device to one of the USB ports with USB cable part number 6980503.

12. BIOS FUNCTIONS

The BIOS on the Quantum SBC provides access to many valuable features. These instructions show how to enter the BIOS, set up features, and restore the BIOS to its default settings.

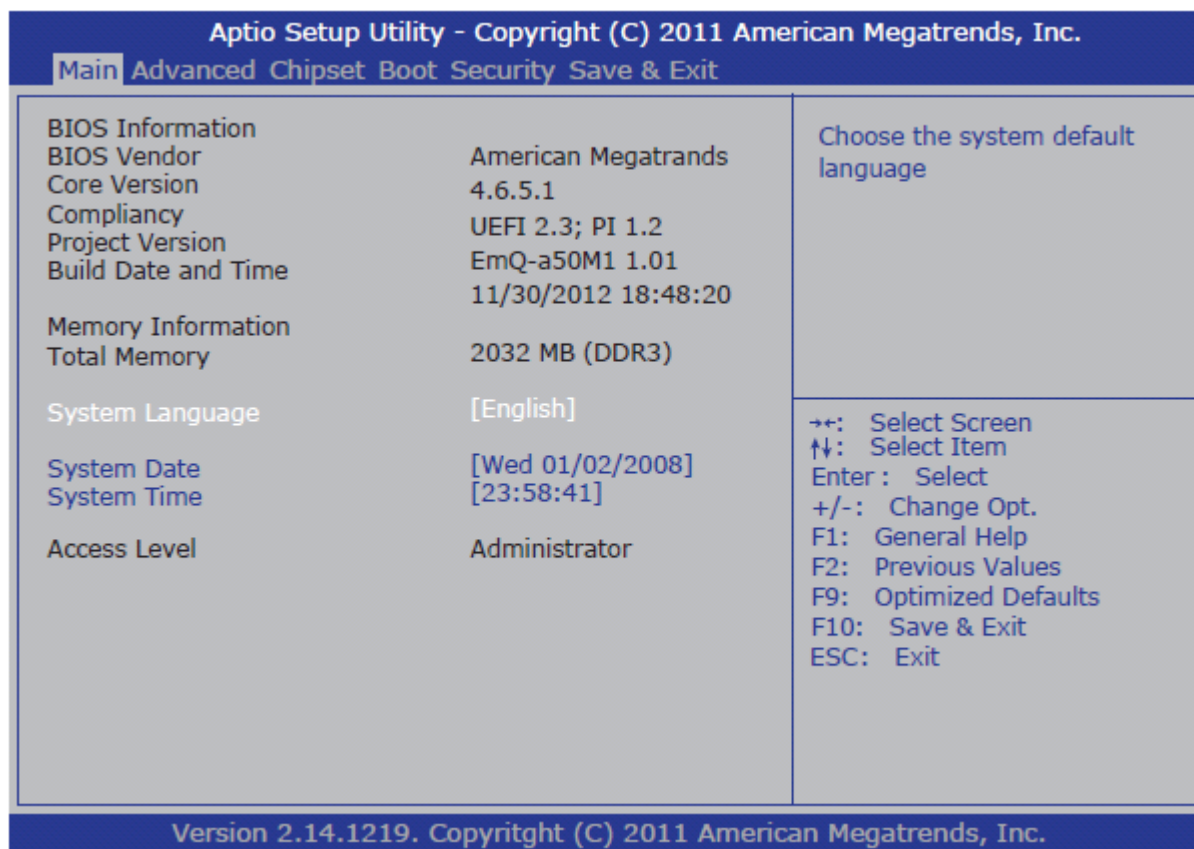
The BIOS Setup utility controls BIOS settings and configures various system features. The system settings are stored in the system's BIOS ROM. And the BIOS is activated once the computer powers on.

12.1 Access BIOS Setup:

To access the BIOS Setup, follow the steps below:

1. Connect the Quantum SBC to a monitor.
2. Turn on the monitor.
3. Supply power to the Quantum SBC.
4. Continuously press the Delete key once the computer powers on until the BIOS Setup utility opens.

Whatever menu or submenu is selected thereafter, the menu or submenu is presented in two panes onscreen. The left pane displays all the settings that are accessible to users while the right pane shows the setting direction. Each menu offers a set of appropriate settings. When a setting is selected on the left pane, it becomes highlighted in white. Available settings are enclosed in brackets while the non-settings are presented in dark gray.



12.2 Key Commands

The BIOS Setup utility relies on a keyboard to receive user's instructions. Use the following keys to use the utility.

Keystroke	Function
← →	Moves left/right between the top menus.
↓ ↑	Moves up/down between highlight items.
Enter	Selects an highlighted item/field.
Esc	On the top menus: <ul style="list-style-type: none"> ▶ Hit Esc to quit the utility without saving changes to the BIOS settings. (The screen will prompt a message asking you to select OK to confirm or Cancel to return to the BIOS settings.) On the submenus: <ul style="list-style-type: none"> ▶ Hit Esc to quit current screen and return to the top menu.
Page Up / +	Increases current value to the next higher value or switches between available options.
Page Down / -	Decreases current value to the next lower value or switches between available options.
F1	Opens the Help of the BIOS Setup utility.
F10	Exits the utility saving the changes that have been made. (The screen then prompts a message asking you to select OK to confirm or Cancel to return to the BIOS settings.)

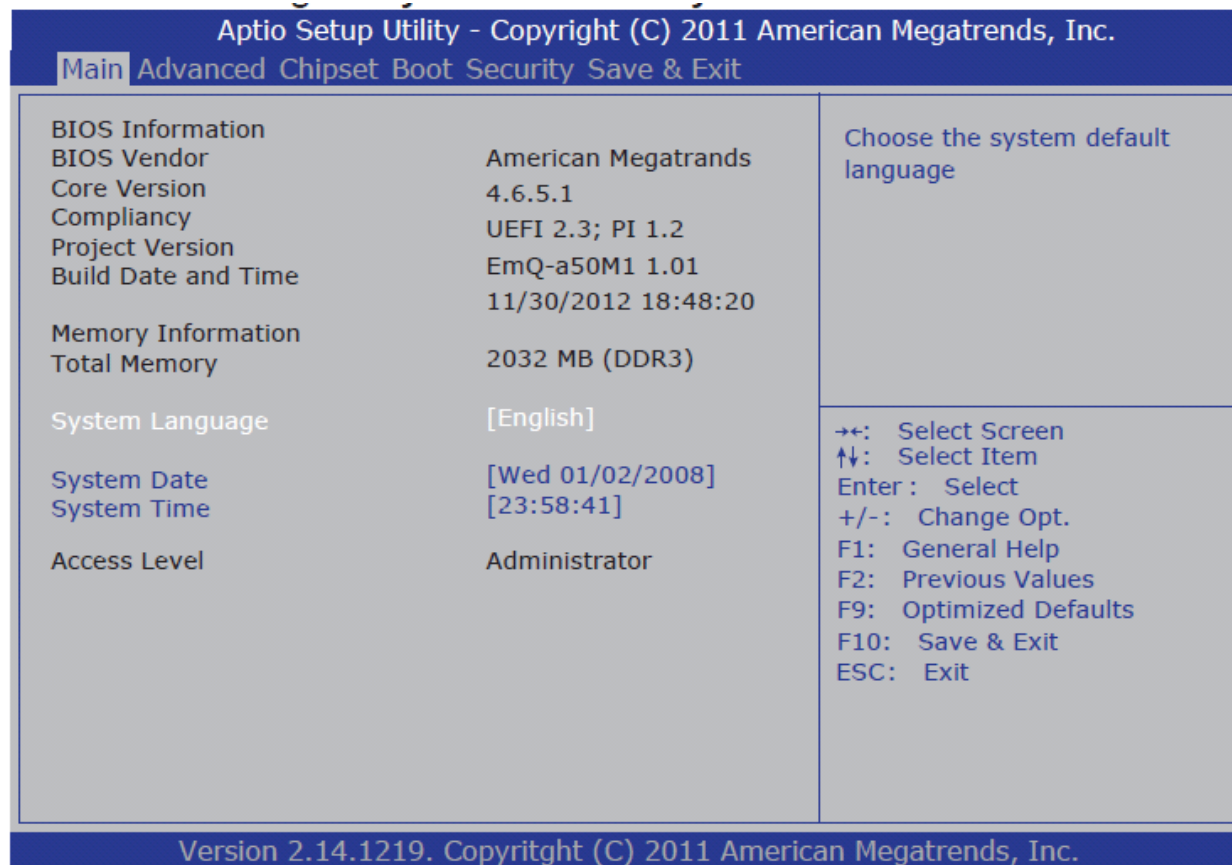
Note a "WARNING" shows in the left pane onscreen when making any change to the BIOS settings.

12.3 The Menus

The Quantum SBC features the BIOS Setup with six menus, which are explained hereafter in this chapter.

12.3.1 Main

The Main menu displays some important BIOS and memory information and features the settings of System Date and System Time.



The displayed info is:

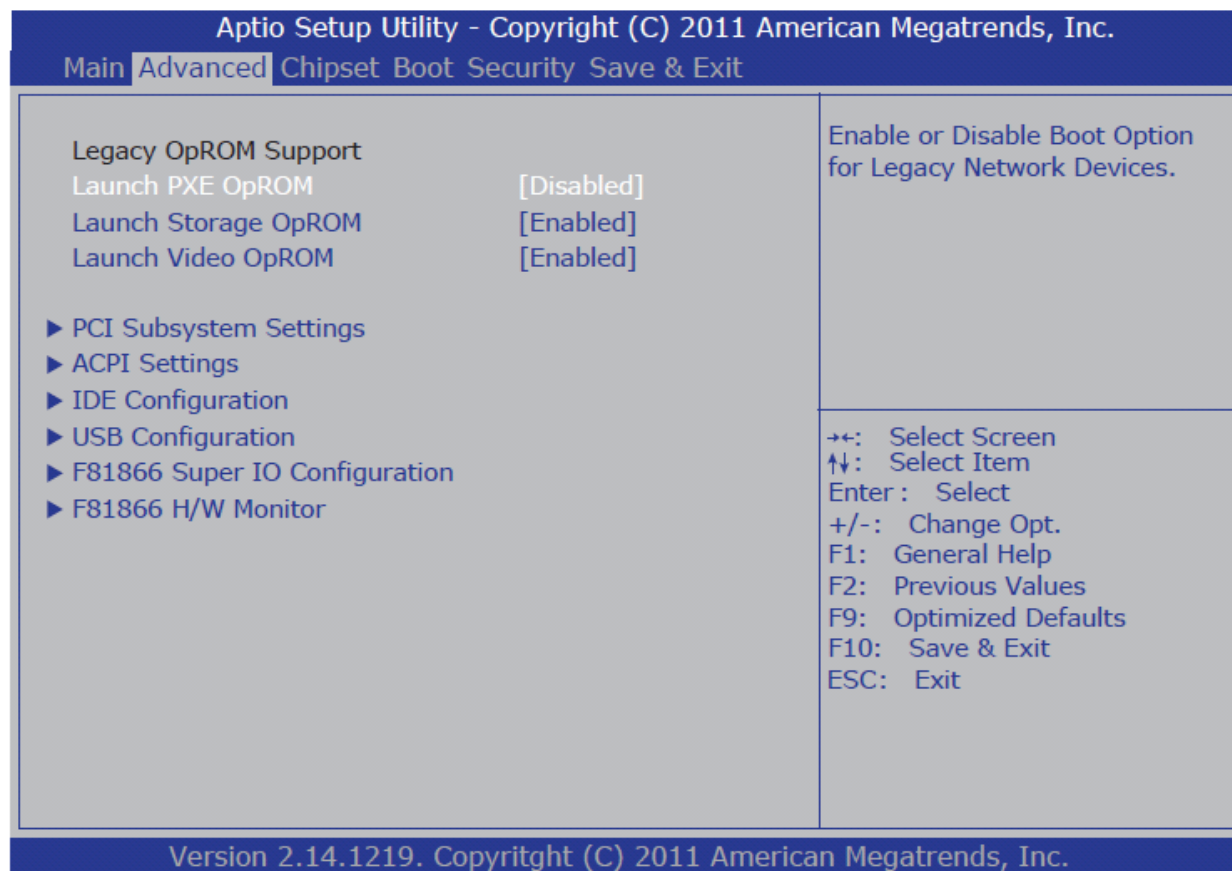
Group	Info	Description
BIOS Information	BIOS Vendor	Delivers the provider of the BIOS Setup utility.
	Core Version	Delivers the version of the core.
	Compliance	Delivers the UEFI support.
	Project Version	Delivers the computer's BIOS version.
	Build Date and Time	Delivers the date and time the BIOS Setup utility was made/ updated.
Memory Information	Total Memory	Delivers the onboard DDR3L memory capacity.
Access Level	Administration	Delivers the level by which the BIOS Setup utility is being accessed at the moment. ▶ EmQ-a50M1 is provided with the administrator level only.

The featured settings are:

Setting	Description
System Language	The system language is set to English and cannot be changed.
System Time	Sets system time.
System Date	Sets system date.

12.3.2 Advanced

Use the Advanced menu to control the system's PCI, ACPI, IDE, USB and Super I/O.



The featured settings and submenus are:

Setting		Description
Legacy OpROM Support	Launch PXE OpROM	Enables/disables the boot option for legacy network devices. <ul style="list-style-type: none"> ▶ Disabled is the default ▶ "PXE" means "Preboot Execution Environment", a series of methods to get a typical Windows-based computer to boot up without a hard drive or boot diskette.
	Launch Storage OpROM	Enables/disables running the legacy option ROM for video devices. <ul style="list-style-type: none"> ▶ Enabled is the default.
	Launch Video OpROM	Enables/disables the boot option for the legacy video devices with option ROM. <ul style="list-style-type: none"> ▶ Options available are Disabled, Enabled (default) and Enabled when no UEFI driver. ▶ Do not disable this setting unless you have video device with UEFI driver. This setting is auto re-enabled if no UEFI video device is available. If the screen goes black after this setting is disabled, reset the system.

PCI Subsystem Settings

This submenu configures PCI, PCI-X and PCI Express. The featured settings and submenus are:

Setting / Submenu	Description
PCI ROM Priority	Defines the PCI option ROM to launch when there are multiple option ROMs (Legacy and EFI compatible). ▶ Options available are Legacy ROM (default) and EFI Compatible ROM .
PCI Express Settings	Sets the ASPM (Active State Power Management) level. ▶ Set it to Force L0s to force all links to L0s state. ▶ Set it to Auto to leave it on BIOS auto configuration. ▶ Set it to Disabled to disable ASPM. (default) ▶ Note enabling ASPM may cause some PCI-E devices to fail.

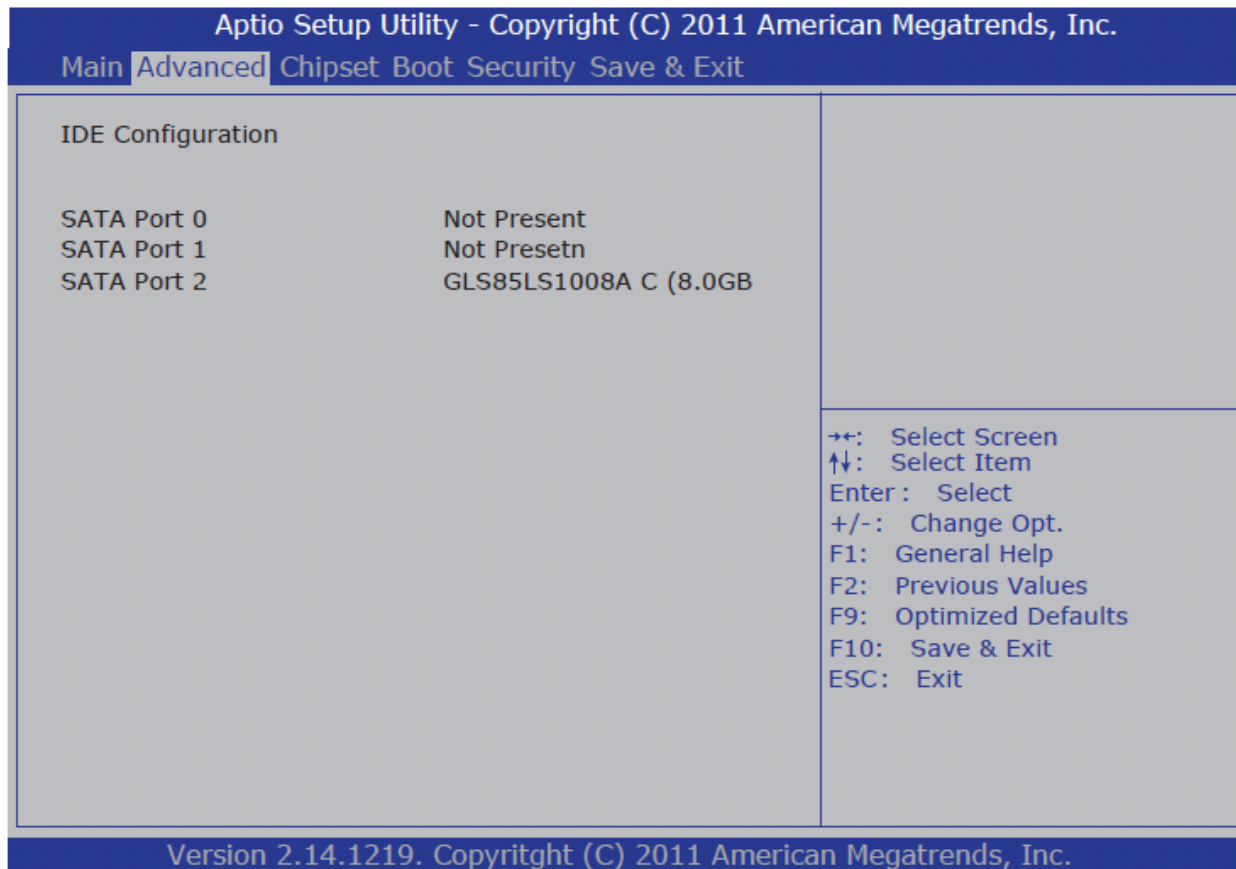
ACPI Settings

ACPI Settings configure the system's ACPI (Advanced Configuration and Power Interface). The featured settings are:

Setting	Description
Enable ACPI Auto Configuration	Enables/disables BIOS to/from auto-configuring ACPI . ▶ Disabled is the default.
Enable Hibernation	Enables/disables the system to/from hibernation (OS/S4 Sleep State). ▶ This setting may not be effective with some OS. ▶ Enabled is the default. ▶ This setting is available only when Enable ACPI Auto Configuration is disabled.
ACPI Sleep State	Sets the highest ACPI sleep state that system enters when the suspend button is hit. ▶ Options available are Suspend Disabled and S3 (Suspend to RAM) (default).

IDE Configuration

Select IDE Configuration to view the system's status of IDE, i.e. the integrated device interface, a type of disk-drive interface in which the controller electronics reside on the drive itself to eliminate the need for a separate adapter card.



USB Configuration

USB Configuration displays the info of the connected USB devices and configures USB parameters. The featured settings are:

Setting	Description
Legacy USB Support	<p>Enables/disables legacy USB support.</p> <ul style="list-style-type: none"> Options available are Enabled (default), Disabled and Auto. Select Auto to disable legacy support if no USB device are connected. Select Disabled to keep USB devices available only for EFI applications.
EHCI Hand-off	<p>Enables/disables a workaround for the operating systems that have no EHCI hand-off support.</p> <ul style="list-style-type: none"> Disabled is the default.

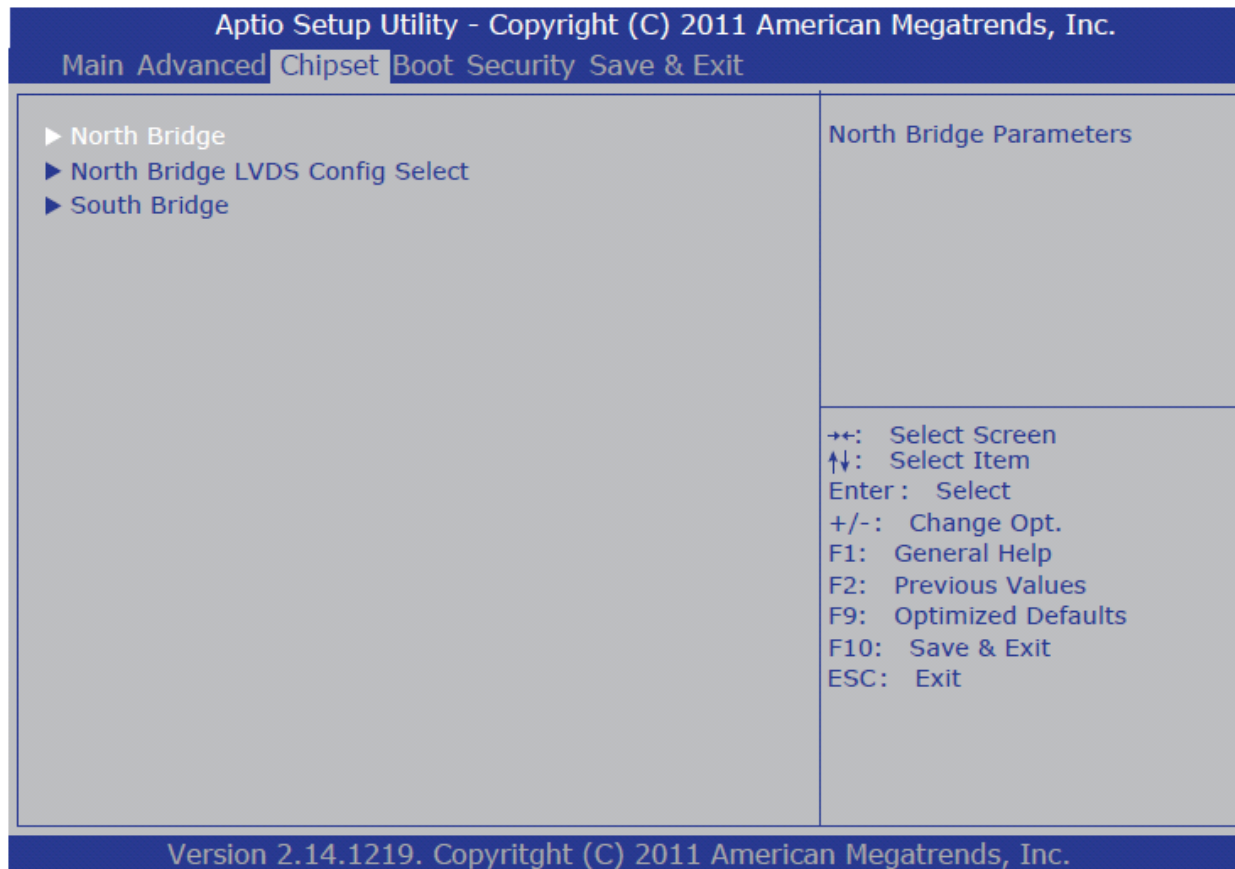
SCH3114 Super I/O Configuration

SCH3114 Super I/O Configuration is a submenu to configure the system's Super IO chip SMSC SCH3114 to optimize the serial ports on the system. The featured submenus are:

Submenu	Description	
Serial Port # Configuration	Configures the system's serial ports (COM port). The featured settings are:	
	Setting	Description
	Serial Port	Enables/disables the serial port. ▶ Enabled is the default.
	Change Settings	Optimizes the IO address and IRQ info for the serial port. ▶ This setting is available only when the serial port is enabled. ▶ Options available are: IO=3F8h; IRQ=4; (default) IO=3F8h; IRQ=3,4,5,6,7,10,11,12; IO=2F8h; IRQ=3,4,5,6,7,10,11,12; IO=3E8h; IRQ=3,4,5,6,7,10,11,12; IO=2E8h; IRQ=3,4,5,6,7,10,11,12;

12.3.3 Chipset

This menu configures the system's chipset features including bus speed management, graphics and the access to the system memory. The chipset also coordinates the communications with the PCI bus.



The featured submenus are North Bridge, North Bridge LVDS Config Select, and South Bridge which are explained in the following of this section.

North Bridge

This submenu configures the system's north bridge features including graphics, memory and socket 0. This submenu also presents some important memory information. The featured settings and submenus are:

Info	Description
Memory Clock	Delivers the current memory clock frequency.
Total Memory	Delivery the total capacity of the onboard DDR3L memory.

GFX Configuration

This submenu features the following settings to configure the system's graphics:

Setting	Description								
NB GPP Core Config	<p>Configures the north bridge GPP (general purpose ports) core.</p> <ul style="list-style-type: none"> Options available are: Disabled, GPP_CORE_x4x4, GPP_CORE_x4x2x2, GPP_CORE_x4x2x1x1, GPP_CORE_x4x1x1x1x1 (default) 								
Port # Control	<p>Enables/disables the port.</p> <ul style="list-style-type: none"> Options available are: Enabled (default) and Disabled. When enabled, the followings settings are available: <table> <tr> <th>Setting</th><th>Description</th></tr> <tr> <td>ASPM Mode Control</td><td> <p>Sets the ASPM level for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), L0s Entry, L1 Entry and L0s and L1 Entry. ASPM for "Active State Power Management". </td></tr> <tr> <td>Hotplug Mode Control</td><td> <p>Sets the hotplug mode for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), Hotplug Basic, Hotplug Server, Hotplug Enhanced and Hotplug Inboard. </td></tr> <tr> <td>Link Speed</td><td> <p>Sets the PCIe link speed for the port.</p> <ul style="list-style-type: none"> The link speed may be overwritten by PSPP setting. Options available are: Max Speed (default), PCIe Gen1 and PCIe Gen2. </td></tr> </table>	Setting	Description	ASPM Mode Control	<p>Sets the ASPM level for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), L0s Entry, L1 Entry and L0s and L1 Entry. ASPM for "Active State Power Management". 	Hotplug Mode Control	<p>Sets the hotplug mode for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), Hotplug Basic, Hotplug Server, Hotplug Enhanced and Hotplug Inboard. 	Link Speed	<p>Sets the PCIe link speed for the port.</p> <ul style="list-style-type: none"> The link speed may be overwritten by PSPP setting. Options available are: Max Speed (default), PCIe Gen1 and PCIe Gen2.
Setting	Description								
ASPM Mode Control	<p>Sets the ASPM level for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), L0s Entry, L1 Entry and L0s and L1 Entry. ASPM for "Active State Power Management". 								
Hotplug Mode Control	<p>Sets the hotplug mode for the port.</p> <ul style="list-style-type: none"> Options available are: Disabled (default), Hotplug Basic, Hotplug Server, Hotplug Enhanced and Hotplug Inboard. 								
Link Speed	<p>Sets the PCIe link speed for the port.</p> <ul style="list-style-type: none"> The link speed may be overwritten by PSPP setting. Options available are: Max Speed (default), PCIe Gen1 and PCIe Gen2. 								
PSPP Policy	<p>Sets the PSPP (PCIe speed power policy).</p> <ul style="list-style-type: none"> Options available are Disabled, Performance, Balanced-High, Balanced -Low (default) and Power Saving. 								

Memory Configuration

This submenu features the following settings to configure the system's memory:

Setting	Description
Integrated Graphics	<p>Enables/disables the integrated graphics controller, or leaves it on BIOS auto-configuration.</p> <ul style="list-style-type: none"> Options available are Auto (default), Disabled and Force. Select Force to enable the integrated graphics controller.
UMA Frame buffer size	<p>Sets the UMA (Unified Memory Architecture) frame buffer size.</p> <ul style="list-style-type: none"> This setting is available only when the Integrated Graphics is enabled. Options available are 32M, 64M, 128M, 256M (default), 512M, 1G and 2G.
Bank Interleaving	<p>Enables/disables "bank interleaving", an advanced chipset technology to improve memory performance by masking the refresh cycles of each memory bank.</p> <ul style="list-style-type: none"> Disabled is the default.

Socket 0 Information

Socket 0 Information enables viewing the CPU's Socket 0 information such as the starting/ending address and the presence or absence of memory modules in the DIMM slots.

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Main Advanced Chipset Boot Security Save & Exit

Socket 0 Information

Starting Address: 0KB

Ending Address: 2097151KB

Dimm0: size = 2048MB, speed = 667MHz

Dimm1: Not present

→←: Select Screen
 ↑↓: Select Item
 Enter: Select
 +/-: Change Opt.
 F1: General Help
 F2: Previous Values
 F9: Optimized Defaults
 F10: Save & Exit
 ESC: Exit

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North Bridge LVDS configuration Select

This submenu features the following settings to configure the INT15 options for the LVDS:

Setting	Description
DP0 Output Mode	Sets the display type for display port 0, the internal LCD panel. ► Options available are LVDS (default) and Disabled.
DP1 Output Mode	Sets the display type for display port 1, the extended display. ► Options available are Single Link DVI-D (default) and Disabled.
LVDS Resolution	Sets the resolution for LVDS. ► Options available are: LVDS Option 1 640 x 480 18Bit Single LVDS Option 2 800 x 600 18Bit Single LVDS Option 3 1024x 600 18Bit Single LVDS Option 4 1024 x 768 18Bit Single (default) LVDS Option 5 1280 x 720 18Bit Single LVDS Option 6 1280 x 800 18Bit Single LVDS Option 7 1366 x 768 18Bit Single LVDS Option 8 1440 x 900 18Bit Single LVDS Option 9 1366 x 768 24Bit Single LVDS Option 10 1440 x 900 24Bit Single LVDS Option 11 1280 x 1024 24Bit Dual LVDS Option 12 1440 x 1050 24Bit Dual LVDS Option 13 1600 x 900 24Bit Dual LVDS Option 14 1680 x 1050 24Bit Dual LVDS Option 15 1600 x 1200 24Bit Dual LVDS Option 16 1920 x 1080 24Bit Dual

South Bridge

Select this submenu to view the south bridge's CIM version and to configure its features.

SB SATA Configuration

Use this submenu to configure the system's SATA feature by the following settings:

Setting	Description
OnChip SATA Channel	Enables/disables the Serial ATA feature. ▶ Enabled is the default.
OnChip SATA Type	Sets the storage type for the Serial ATA interface. ▶ Options available are RAID, AHCI and Legacy IDE (default). ▶ This setting is available only when OnChip SATA Channel is enabled.
SATA IDE Combined Mode	Enables/disables supporting both SATA and PATA devices. . ▶ Enabled is the default. ▶ This setting is available only when OnChip SATA Channel is enabled.
Combined Mode Option	Sets how to support both SATA and PATA by defining which is the primary drive. ▶ Options available are SATA as primary (default) and SATA as secondary. ▶ This setting is available only when both OnChip SATA Channel and SATA Combined Mode are enabled and OnChip SATA Type isn't set to AHCI.

SB USB Configuration

Use this submenu to configure the system's USB features:

Setting	Description
OHCI HC (BUS 0 Dev 18 Fn 0)	Enables/disables OHCI HC (Bus 0 Dev 18 Fn 0) ▶ OHCI means "Open Host Controller Interface", an interface that enables a computer host to interface with USB or FireWire hardware. ▶ Enabled is the default.
OHCI HC (BUS 0 Dev 19 Fn 0)	Enables/disables OHCI HC (Bus 0 Dev 19 Fn 0) ▶ Enabled is the default.
OHCI HC (BUS 0 Dev 22 Fn 0)	Enables/disables OHCI HC (Bus 0 Dev 22 Fn 0). ▶ Enabled is the default.
OHCI HC (BUS 0 Dev 20 Fn 5)	Enables/disables OHCI HC (Bus 0 Dev 20 Fn 5). ▶ Enabled is the default.

12.3.4 Boot

The **Boot** menu configures how to boot the system by defining boot device priority.

Aptio Setup Utility - Copyright (C) 2011 American Megatrends, Inc.
 Main Advanced Chipset **Boot** Security Save & Exit

<div> Boot Configuration Setup Prompt Timeout 1 Bootup NumLock State [On] </div> <div style="margin-top: 20px;"> Boot Option Priorities Boot Option #1 [SATA PS: GLS85LS1 ...] </div> <div style="margin-top: 20px;"> Hard Drive BBS Priorities </div>	<div> Number of seconds to wait for setup activation key. 65535 (0xFFFF) means indefinite waiting. </div> <div style="margin-top: 20px;"> →←: Select Screen ↑↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit </div>
--	---

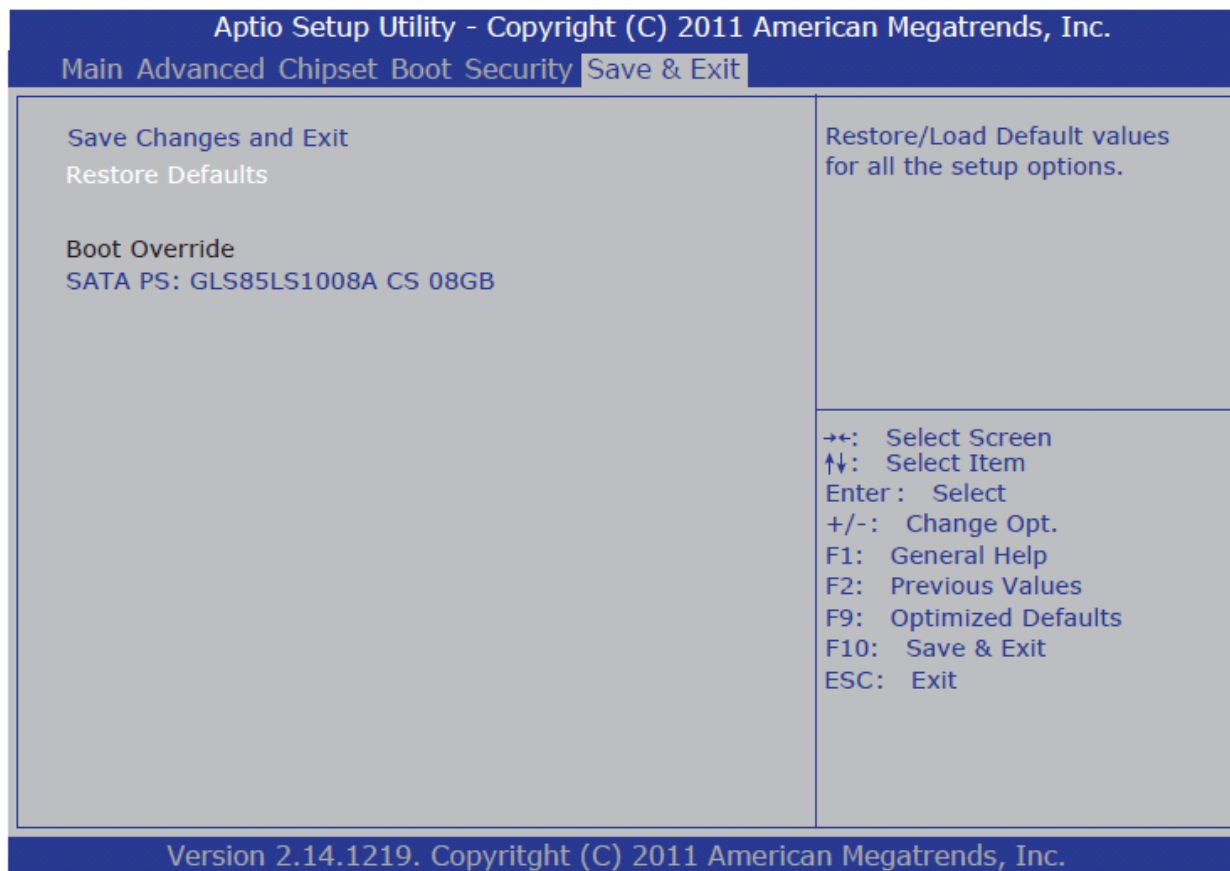
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The settings are:

Group	Setting	Description
Boot Configuration	Setup Prompt Timeout	Sets how long to show the prompt to enter BIOS Setup. ▶ Sets it to 65535 to show the prompt indefinitely.
	Bootup NumLock State	Sets keyboard's NumLock state when the system boots up. ▶ Options available are On (default) and Off.
Boot Option Priority	Boot Option #1	Sets the very 1st boot device among the available device types. ▶ Option(s) available are the available device type(s).
Hard Drive BBS Priorities		Sets hard drive boot priority. ▶ BBS for "BIOS Boot Specification". ▶ Options available are the built-in hard drive (the default) and Disabled.

12.3.6 Save & Exit

The Save & Exit menu features a handful of commands to launch actions from the BIOS Setup utility regarding saving changes, quitting the utility and recovering defaults.



The settings are:

Setting	Description
Save Changes and Reset	Saves the changes and resets the system. ► This is a command to launch action from the BIOS Setup utility rather than a setting.
Restore Defaults	Restores all settings to factory defaults. ► This is a command to launch action from the BIOS Setup utility rather than a setting.
Boot Override	Shows a list of the available boot devices in the system so users can boot up the system immediately by any of the listed devices regardless of the currently configured boot priority. ► This is a command to launch action from the BIOS Setup utility rather than a setting.

13. PIC MICROCONTROLLER

The Quantum SBC contains a PIC microcontroller that is used to provide various functions including serial port configuration, general purpose I/O lines, A/D lines, pulse width modulators, generate wake events, and others. This section describes the command sets that can be used to communicate with the PIC controller.

The list below describes the constants that have been used in this section.

• MESSAGE_SIG	0x3232
• COMMAND_AREYOU	0x01
• COMMAND_WRITE_EPROM	0x03
• COMMAND_READ_EPROM	0x05
• COMMAND_CONFIG_DIOPORT	0x07
• COMMAND_DIO_OUTPUT	0x09
• COMMAND_DIO_READ	0x0B
• COMMAND_ANALOG_READ	0x0D
• COMMAND_CONFIG_PWM	0x0F
• COMMAND_WATCHDOG_SET	0x17
• COMMAND_WATCHDOG_READ	0x19
• COMMAND_WATCHDOG_TRIGGER	0x1B
• COMMAND_CALENDAR_WAKEUP	0x1D
• COMMAND_MTBF_DATA	0x1F
• COMMAND_MTBF_POWER	0x21
• COMMAND_RTC_READ	0x23
• COMMAND_RTC_WRITE	0x25
• COMMAND_SET_COM_MODE	0x27
• COMMAND_GET_COM_MODE	0x29
• COMMAND_BOARD_VOLTAGE	0x2B
• COMMAND_CONFIG_READ_DIOPORT	0x2F
• COMMAND_RECEIVER_AREYOUTHERE	0x02
• COMMAND_RECEIVER_EPROMDATA	0x04
• COMMAND_RECEIVER_DIODATA	0x0C
• COMMAND_RECEIVER_ANALOG_DATA	0x0E
• COMMAND_RECEIVER_WATCHDOG_SETTINGS	0x1A
• COMMAND_RECEIVER_ACK	0x1C
• COMMAND_RECEIVER_MTBF_DATA	0x1E
• COMMAND_RECEIVER_MTBF_POWER	0x20
• COMMAND_RECEIVER_RTC_DATA	0x22
• COMMAND_RECEIVER_GET_COM_MODE	0x24
• COMMAND_RECEIVER_BOARD_VOLTAGE	0x26
• COMMAND_RECEIVER_CONFIG_READ_DIOPORT	0x2A

13.1 Are you there

Command Description:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_AREYOU: Command id for the "are you there command"
3	1	0: No extra data sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_AREYOUTHERE
3	1	Specifies the length of the buffer as 1 byte long
4	1	Version Number of the firmware

Comments:

This command is used to retrieve the firmware version running on the target system. If the firmware version is 2, then the message sent is 3232010 and the received message is 3232020102.

13.2 Configure DIO Port Command

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_DIOPORT: Command id for the message
3	1	1
4	1	Pin number

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is used to toggle the configuration direction of a digital IO pin. The value of the pin number must be between 0 and 9.

13.3 DIO Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_DIO_READ: Command id for the message
3	1	0

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_DIODATA: Command id for the message
3	1	2: Indicating 2 bytes data
4	2	The state of all the DIO pins from 0 to 9

Comments:

This command reads the data from all the pins starting from 0 and ending with 9. The response contains the data for all the pins encoded in 2 bytes of data. Bit 0 to 7 for the first data byte will contain the data for DIO 0 to 7 and bit 0 and 1 of second data byte will contain the data for DIO 8 and 9.

13.4 DIO Output

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_DIO_OUTPUT: Command id for the message
3	1	1
4	1	Pin number

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command toggles the current state of the selected pin from LOW to HIGH, or HIGH to LOW. The response is an acknowledgement for the successful completion of the command.

13.5 EEPROM Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_READ_EPROM: Command id of the message
3	1	2: Indicating the 2 byte address to be read from the EEPROM
4	2	Contains the address to be read

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_EPROMDATA: Indicating the following data is from reading EEPROM data
3	1	1: Indicating one byte of data to be read
4	1	The data that is requested by the read request

Comments:

The command will be 6 bytes long in which the first two bytes is the command signature, the third byte is the command id, the fourth byte is the length of the data buffer, and the fifth byte is the data which contains the address location. For example, to read location 0x0130 the message will look like this [0x3232] [0x05] [0x02] [0x0130].

13.6 EEPROM WRITE

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WRITE_EPROM: Command id for the message
3	1	3: Indicating 3 bytes of data is sent
4	2	Contains the address location where the data is to be written
6	1	The 1 byte of data that is to be written to the EEPROM section

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is used to write data to the EEPROM. The first four bytes will contain the data, just like other commands, only the command id and length will be different. The firmware has to know the address of the memory location where data will be written and the data itself. Hence for specifying the address, two bytes are used. One byte for the data is filled in the data section. For writing multiple bytes or bulk data, this command can be issued multiple times.

13.7 MTBF POWER CYCLE

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_MTBF_POWER: Command id
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_MTBF_POWER: Indicating the command to process
3	1	4: Indicating 4 bytes of data to follow
4	4	4 byte long counter to be returned as response to this command

Comments:

MTBF data gives the count of the number of power restarts that have occurred in the system. The first two bytes contains the same meaning as the previous commands. The third byte contains the command id for the operation. This command does not need any parameter; hence its data length is zero. To retrieve MTBF data, the message will look like [0x3232] [0x1F] [0x00].

13.8 Watchdog Timeout Set

Command:

Byte	Length	Value and Description																														
0	2	MESSAGE_SIG: Message signature																														
2	1	COMMAND_WATCHDOG_SET: Sets the watchdog timeout to predefined values																														
3	1	1: Indicating 1 byte of data follows																														
4	1	<div>The time value set depending on the following set of values:</div> <table><thead><tr><th>Value</th><th>Time interval</th></tr></thead><tbody><tr><td>0:</td><td>1 sec</td></tr><tr><td>1:</td><td>2 sec</td></tr><tr><td>2:</td><td>4 sec</td></tr><tr><td>3:</td><td>8 sec</td></tr><tr><td>4:</td><td>16 sec</td></tr><tr><td>5:</td><td>32 sec</td></tr><tr><td>6:</td><td>1 min.</td></tr><tr><td>7:</td><td>2 min.</td></tr><tr><td>8:</td><td>4 min.</td></tr><tr><td>9:</td><td>9 min.</td></tr><tr><td>10:</td><td>17 min.</td></tr><tr><td>11:</td><td>35 min.</td></tr><tr><td>12:</td><td>70 min.</td></tr><tr><td>13:</td><td>Disable</td></tr></tbody></table>	Value	Time interval	0:	1 sec	1:	2 sec	2:	4 sec	3:	8 sec	4:	16 sec	5:	32 sec	6:	1 min.	7:	2 min.	8:	4 min.	9:	9 min.	10:	17 min.	11:	35 min.	12:	70 min.	13:	Disable
Value	Time interval																															
0:	1 sec																															
1:	2 sec																															
2:	4 sec																															
3:	8 sec																															
4:	16 sec																															
5:	32 sec																															
6:	1 min.																															
7:	2 min.																															
8:	4 min.																															
9:	9 min.																															
10:	17 min.																															
11:	35 min.																															
12:	70 min.																															
13:	Disable																															

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	<p>Return status for the command</p> <p>0: Operation completed successfully</p> <p>1: Some problem in the operation</p>

Comments:

This command is used to set the time out value for the microcontroller. This feature is useful to reset the microcontroller from a non-responsive state, or when the master system has lost connectivity with the firmware. The first four bytes are organized just like the previous messages and interpreted in the same way in the firmware. The fifth byte contains data specifying the timeout length. For example, to set a 16 second time out value, the message will look like [0x3232] [0x17] [0x01] [0x04].

13.9 Watchdog Trigger

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WATCHDOG_TRIGGER
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

The first three bytes contains data just like the previous commands. There is no extra data required to execute the command, so the fourth byte is 0. The message for a watchdog trigger will look like [0x3232] [0x1B] [0x00].

13.10 Watchdog Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WATCHDOG_READ
3	1	1: Indicating 1 byte of data to be read

Response:

Byte	Length	Value and Description																														
0	2	MESSAGE_SIG: Message signature																														
2	1	COMMAND_RECEIVER_WATCHDOG_SETTINGS: Response ID																														
3	1	0: Indicating no data is sent																														
4	1	<div>The time value set depending on the following set of values:</div> <table><thead><tr><th>Value</th><th>Time interval</th></tr></thead><tbody><tr><td>0:</td><td>1 sec</td></tr><tr><td>1:</td><td>2 sec</td></tr><tr><td>2:</td><td>4 sec</td></tr><tr><td>3:</td><td>8 sec</td></tr><tr><td>4:</td><td>16 sec</td></tr><tr><td>5:</td><td>32 sec</td></tr><tr><td>6:</td><td>1 min.</td></tr><tr><td>7:</td><td>2 min.</td></tr><tr><td>8:</td><td>4 min.</td></tr><tr><td>9:</td><td>9 min.</td></tr><tr><td>10:</td><td>17 min.</td></tr><tr><td>11:</td><td>35 min.</td></tr><tr><td>12:</td><td>70 min.</td></tr><tr><td>13:</td><td>Disable.</td></tr></tbody></table>	Value	Time interval	0:	1 sec	1:	2 sec	2:	4 sec	3:	8 sec	4:	16 sec	5:	32 sec	6:	1 min.	7:	2 min.	8:	4 min.	9:	9 min.	10:	17 min.	11:	35 min.	12:	70 min.	13:	Disable.
Value	Time interval																															
0:	1 sec																															
1:	2 sec																															
2:	4 sec																															
3:	8 sec																															
4:	16 sec																															
5:	32 sec																															
6:	1 min.																															
7:	2 min.																															
8:	4 min.																															
9:	9 min.																															
10:	17 min.																															
11:	35 min.																															
12:	70 min.																															
13:	Disable.																															

Comments:

The command returns an integer as its response, which represents a timeout value depending on the value-time interval chart given above.

13.11 MTBF Power Data:

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_MTBF_DATA: Indicating the command to process
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_MTBF_DATA: Indicating the command to process
3	1	4: Indicating 4 bytes of data

Comments:

This command is similar to the watchdog timeout read command described earlier. It is also 4 bytes long. Only the command id is different. The response of this command returns the boot up time in seconds.

13.12 RTC Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RTC_READ
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_RTC_DATA: Indicating the command to process
3	1	7: Specifying 7 bytes following
4	1	0 – 99 specifying the year's last two digits
5	1	1 – 12 specifying Month: 1 for January, 3 for March, 11 for November, and so on
6	1	1 – 31 Date
7	1	1 – 7 Day of week. 1 for Sunday, 3 for Tuesday, 7 for Saturday, and so on
8	1	0 – 23 Hours
9	1	0 – 59 Minutes
10	1	0 – 59 Seconds

Comments:

This command reads the RTC timer on the microcontroller. Before reading the data, the RTC must be configured with some starting time or else it will give incorrect data. The command structure and description is similar to the watch dog read command or the MTBF power data retrieval command. The command looks like [3232] [19] [00].

13.13 RTC Write

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RTC_WRITE
3	1	7: Specifying 7 bytes following this
4	1	0 – 99 specifying the year's last two digits
5	1	1 – 12 specifying Month: 1 for January, 3 for March, 11 for November, and so on
6	1	1 – 31 Date
7	1	1 – 7 Day of week. 1 for Sunday, 3 for Tuesday, 7 for Saturday, and so on
8	1	0 – 23 Hours
9	1	0 – 59 Minutes
10	1	0 – 59 Seconds

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is always ten bytes long. The first four bytes contain information just like other commands. The next seven bytes of information contain data regarding date information as described in the table above. This command configures and starts the RTC module in the firmware. For example to set 29th Feb 2012 5:00:17 PM (Wednesday is day of the week), the command is [0x3232] [0x25] [0x07] [12] [02] [04] [17] [00] [17]. While reading the RTC data, the time information will appear in this format.

13.14 Set COM Mode

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_SET_COM_MODE
3	1	1: Indicating 1 more byte to be read
4	1	1: Indicates RS-232 protocol to be used 2: Indicates RS-485 protocol to be used 3: SPI (Serial Peripheral Interface) protocol to be used

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operations

Comments:

This command is used to specify what protocol is used by the firmware. This won't be immediately reflected in the firmware; the protocol will be updated after the device is reset. The default protocol is set as SPI communication (The host windows application is uses the SPI protocol). To set the protocol to RS-232, the message looks like [0x3232] [0x27] [0x01] [0x01].

13.15 Get COM Mode

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_GET_COM_MODE
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_GET_COM_MODE: Indicating the command to process
3	1	1: Indicating 1 byte of data to be read
4	1	1: Indicates RS-232 protocol to be used 2: Indicates RS-485 protocol to be used 3: SPI (Serial Peripheral Interface) protocol to be used

Comments:

This command is used to retrieve the protocol used for sending data, or getting data from firmware. The default communication mode is the SPI. The firmware will use the last used protocol (the protocol used for before the last rest) when initializing the firmware

13.16 READ ANALOG DATA

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_ANALOG_READ: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ANALOG_DATA: Response ID
3	1	8: Indicating 8 bytes of data
4	8	8 bytes of data buffer containing the analog values for channels 0 to 3

Comments:

This command retrieves the analog voltage values of channels 0 to 3. The response consists of eight bytes of data which contain the analog voltage for channels 0 to 3 in hex. The data consists of the following values:

1st byte: Lower byte of the voltage value of channel 0

2nd byte: Higher byte of the voltage value of channel 0

3rd byte: Lower byte of the voltage value of channel 1

4th byte: Higher byte of the voltage value of channel 1

5th byte: Lower byte of the voltage value of channel 2

6th byte: Higher byte of the voltage value of channel 2

7th byte: Lower byte of the voltage value of channel 3

8th byte: Higher byte of the voltage value of channel 3

13.17 BOARD VOLTAGES

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_BOARD_VOLTAGE: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_BOARD_VOLTAGE: Command ID
3	1	10: Indicating 10 bytes of data

Comments:

This command retrieves the analog voltage values of channels 6 to 10. The response consists of eight bytes of data which contain the analog voltage for channels 6 to 10 in hex. The data consists of the following values:

1st byte: Lower byte of the voltage value of channel 6

2nd byte: Higher byte of the voltage value of channel 6

3rd byte: Lower byte of the voltage value of channel 7

4th byte: Higher byte of the voltage value of channel 7

5th byte: Lower byte of the voltage value of channel 8

6th byte: Higher byte of the voltage value of channel 8

7th byte: Lower byte of the voltage value of channel 9

8th byte: Higher byte of the voltage value of channel 9

9th byte: Lower byte of the voltage value of channel 10

10th byte: Higher byte of the voltage value of channel 10

13.18 PWM CONTROL

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_PWM: Command ID
3	1	4: Indicating 4 bytes of data
4	4	4 bytes of data: channel number, 2 bytes of frequency, duty cycle percentage between 0 to 100

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1 or non-zero: Some problem in the operations

Comments:

This command enables PWM channels to generate PWM signals of certain frequency and duty cycle. The output pins for different channels are as follows:

Channel #1: P1A/RC2 pin

Channel #2: P1B/RE6 pin

Channel #3: P1C/RE5 pin

Channel #4: P1D/REG4 pin

The response is a status message for successful completion of the command.

13.19 READ DIO CONFIG

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_READ_DIOPORT: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_CONFIG_READ_DIOPORT: Command ID
3	1	2: Indicating 2 bytes of data

Comments:

This command reads the configuration direction for all the pins starting from pin 0 and going to pin 9. The response contains the data for all the pins encoded in 2 bytes of data. Bit 0 to 7 for the first data byte contains the data for DIO 0 to 7, and bit 0 and 1 of second data byte contains the data for DIO 8 and 9.

13.20 CALENDAR WAKEUP

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CALENDAR_WAKEUP: Command ID
3	1	6: Indicating 6 bytes of data
4	6	6 bytes of data containing hour, minute, second, day, month and day of week respectively

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1 or non-zero: Some problem in the operations

Comments:

This command configures the RTC module to generate an alarm on the date and time set in the six bytes of data in the command. An alarm pulse is generated at pin RG4 at the specified time and date. The response is a status response signaling successful completion of command processing.

14. SYSTEM RESET

The Quantum SBC contains a soft reset switch, SW1, and hard reset switch, SW2, to reset the system under defined conditions. Reset occurs when any of the following occurs.

- User causes reset with SW1 or SW 2
- Input voltage drops below 4.75V

A system reset will also cause a reset to any installed add on modules.

15. DATA ACQUISITION CIRCUIT

The Quantum SBC contains a data acquisition subsystem consisting of A/D, digital I/O, pulse width modulators, and counter/timer features.

15.1 Protocol selection

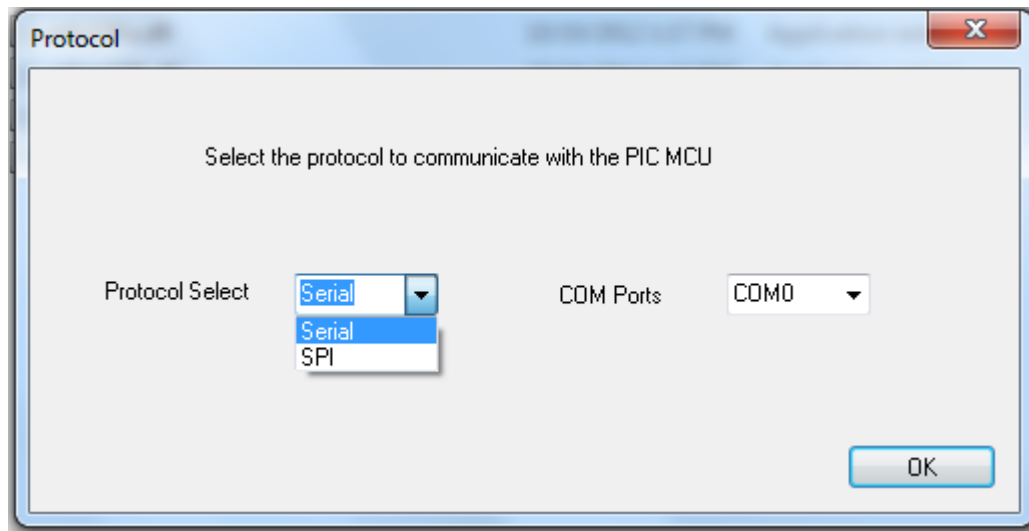


Figure 1: Protocol selection dialog box

This is the first window that appears when the application is started. The user must select a protocol to communicate with the PIC microcontroller. The user may select one of the two options: Serial or SPI.

Initially, the COM Ports box will be enabled. If the user selects serial protocol, then he must select the proper COM port from the COM Port box. If the user selects SPI protocol then the COM Ports box is disabled.

When done, click the "OK" button. After clicking the "OK" button, the main application will start and the application will communicate with the microcontroller depending on the choice selected.

15.2 Application Navigation

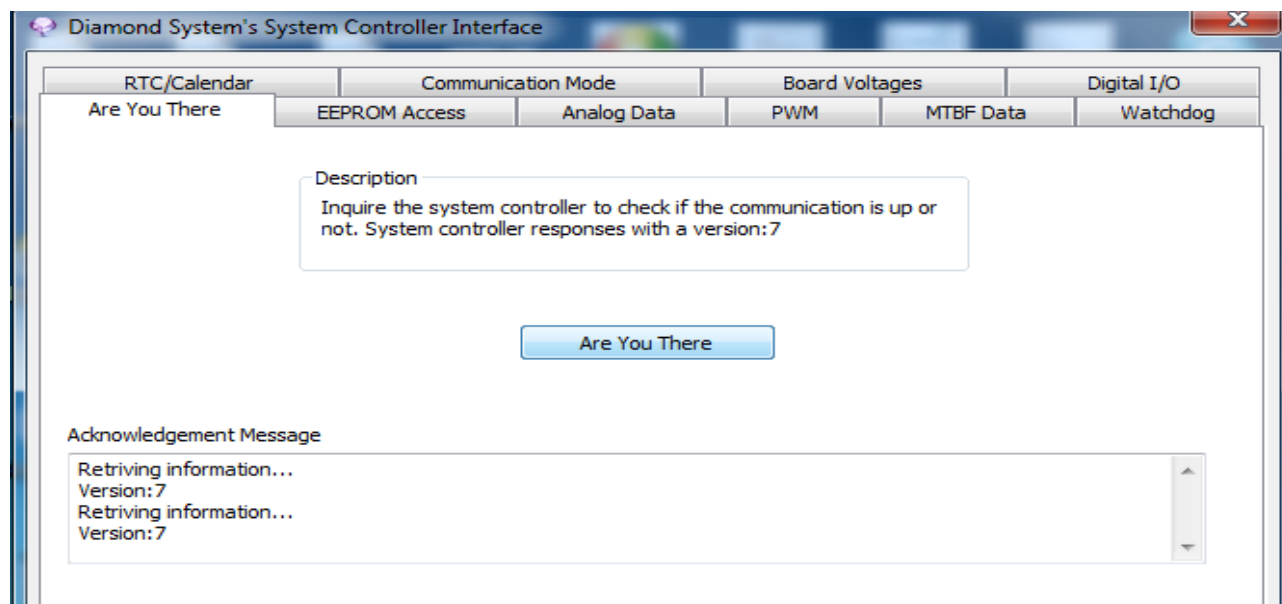


Figure 2: Main UI

The application is created as a tabbed dialog based user interface. Each page in the application performs related task of a particular module. For sequential navigation between the pages the Previous and Next button can be used. Pages can be accessed randomly. To exit the application, click on Close button. The application will close after a confirmation from the user.

Every page is described in the following sections with information about the functionality of the module. A message section which logs actions and return status of a particular operation. A separate log is maintained for every module. Every module has one or more operation section where the user provides required data. Some of the fields work as both user inputs and outputs. If invalid data is provided; the corresponding message will be shown at the logging section. An error of any operation will be logged in the message logging section.

15.3 Are You There

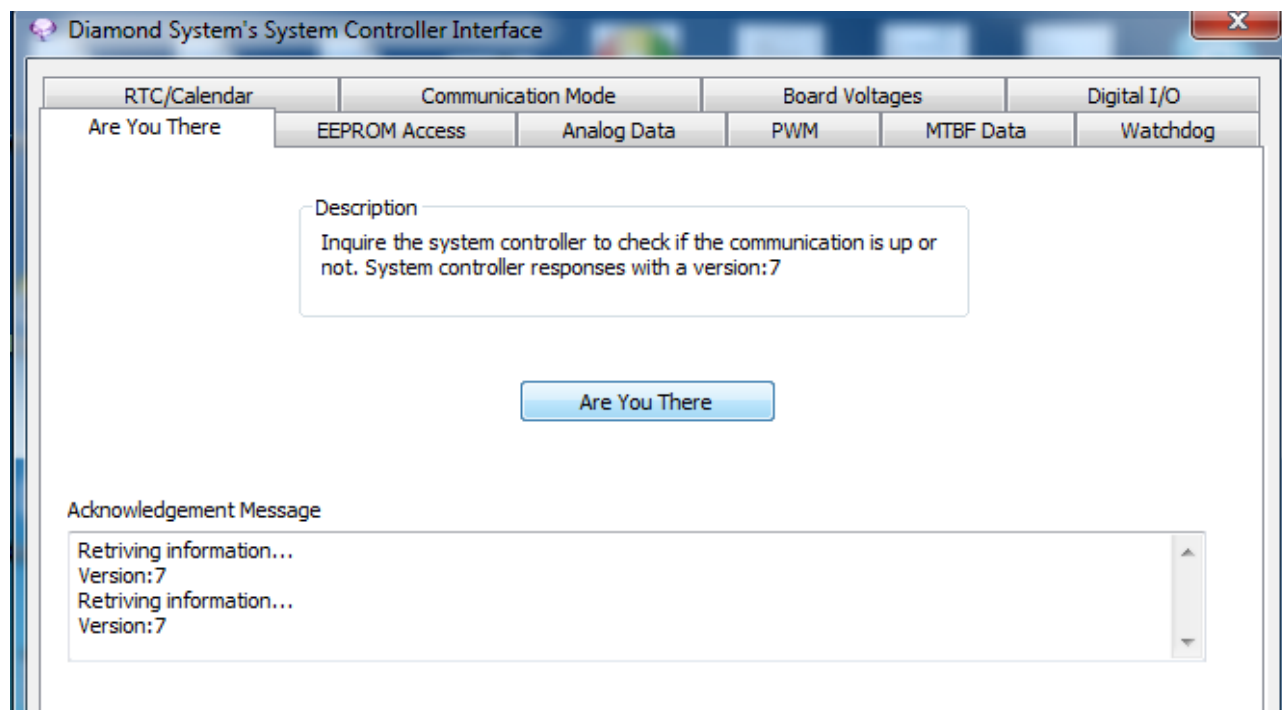


Figure 3: Are You There screen

The "Are You There" page gives information regarding the version of the firmware which is built into the target system. To get the information click on the "Are you there" button and the corresponding message will be displayed on the bottom section of the window. If the target system is not connected to the system the program will report in 2 seconds that no target system is found. If a target system is connected it will show its firmware version number. The section can be used for testing the firmware version and target system attachment status.

Please note that the protocol used cannot be changed when the application is running. To change the protocol, the application must be restarted and appropriate protocol must be selected at the beginning.

15.4 Digital I/O

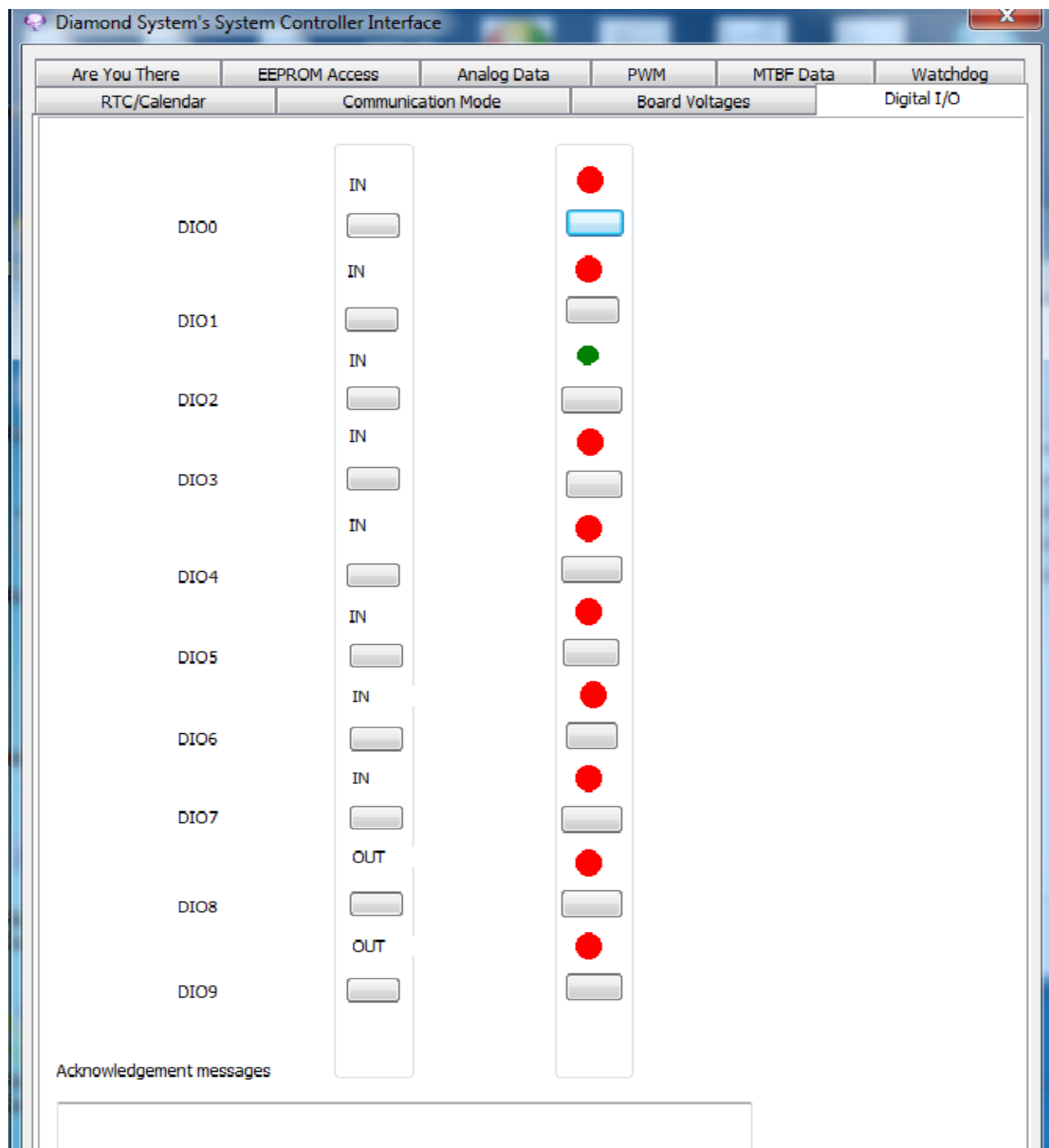


Figure 4: Digital I/O screen

This section deals with digital input and output of the target system. There are two main operations can be performed on the digital I/O port; configure, and toggling a pin state from HIGH to LOW or LOW to HIGH. There are two columns:

The first column consists of buttons to configure the corresponding DIO pin as IN/OUT direction. The current configuration for a pin will be shown as IN/OUT above the button.

The second column consists of buttons to toggle the state of pins from HIGH to LOW and LOW to HIGH. The red and green circles above the buttons denote the current state of the pin: green circle denotes HIGH and red circles denote LOW.

15.5 EEPROM Access

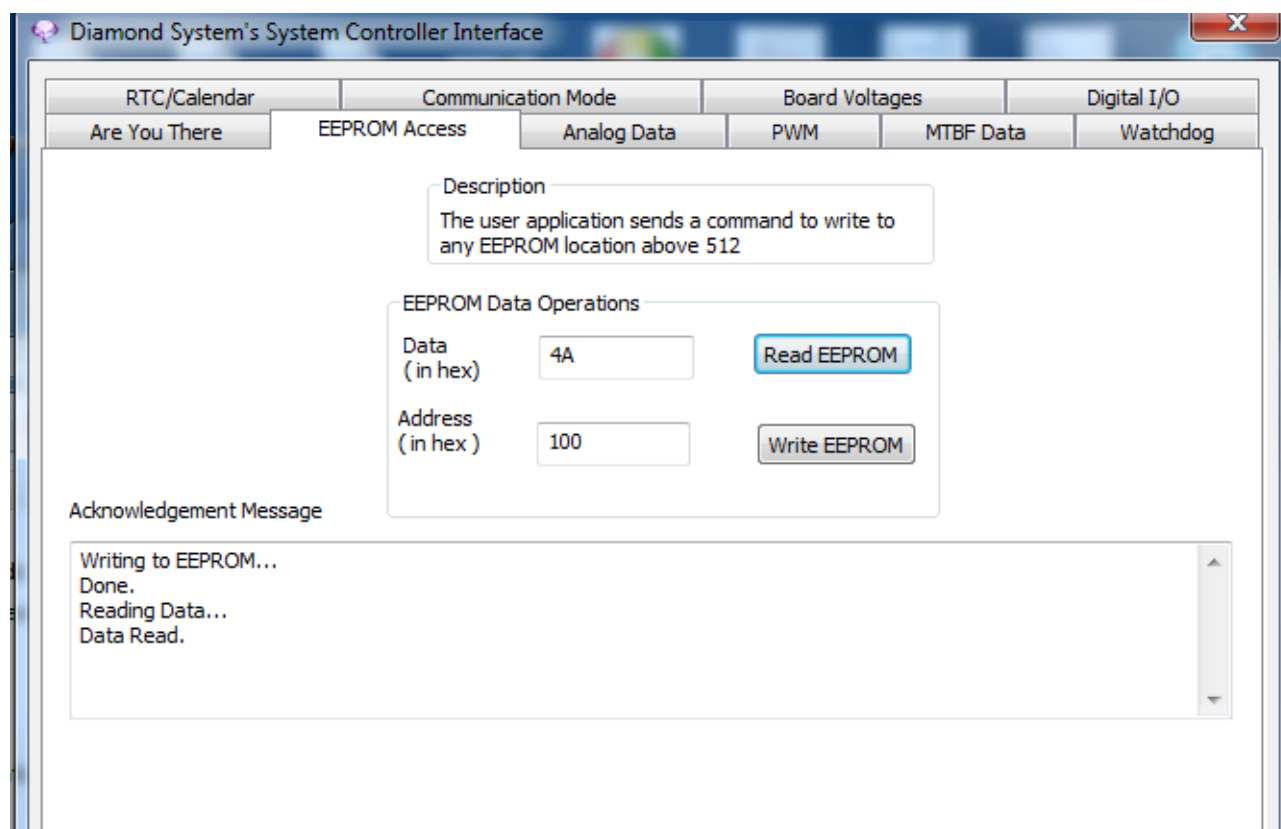


Figure 5: EEPROM Access screen

This module performs operations on the EEPROM of the target system. EEPROM is the non-volatile memory module of the target system. If the user wants to store data that persists after power off of the system then this module should be used. Using this section the user can read and write to the EEPROM present in the system. The addressing is 0 index based addressing mode. The user can read any location of the memory but can only write to address upper to 512. Data and address are both specified in hexadecimal format. Both upper case and lower case data are supported. While providing hex data, invalid hex characters are ignored. For example 0xHHA0 will be evaluated as 0xA0. If an error occurs then the corresponding message is displayed in the logging section.

For reading data from a memory address, enter the address in hex in the text box named "Address" and click the "Read EEPROM" button. If the operation is successful then the following message will be displayed in the "Acknowledgement Message" area:

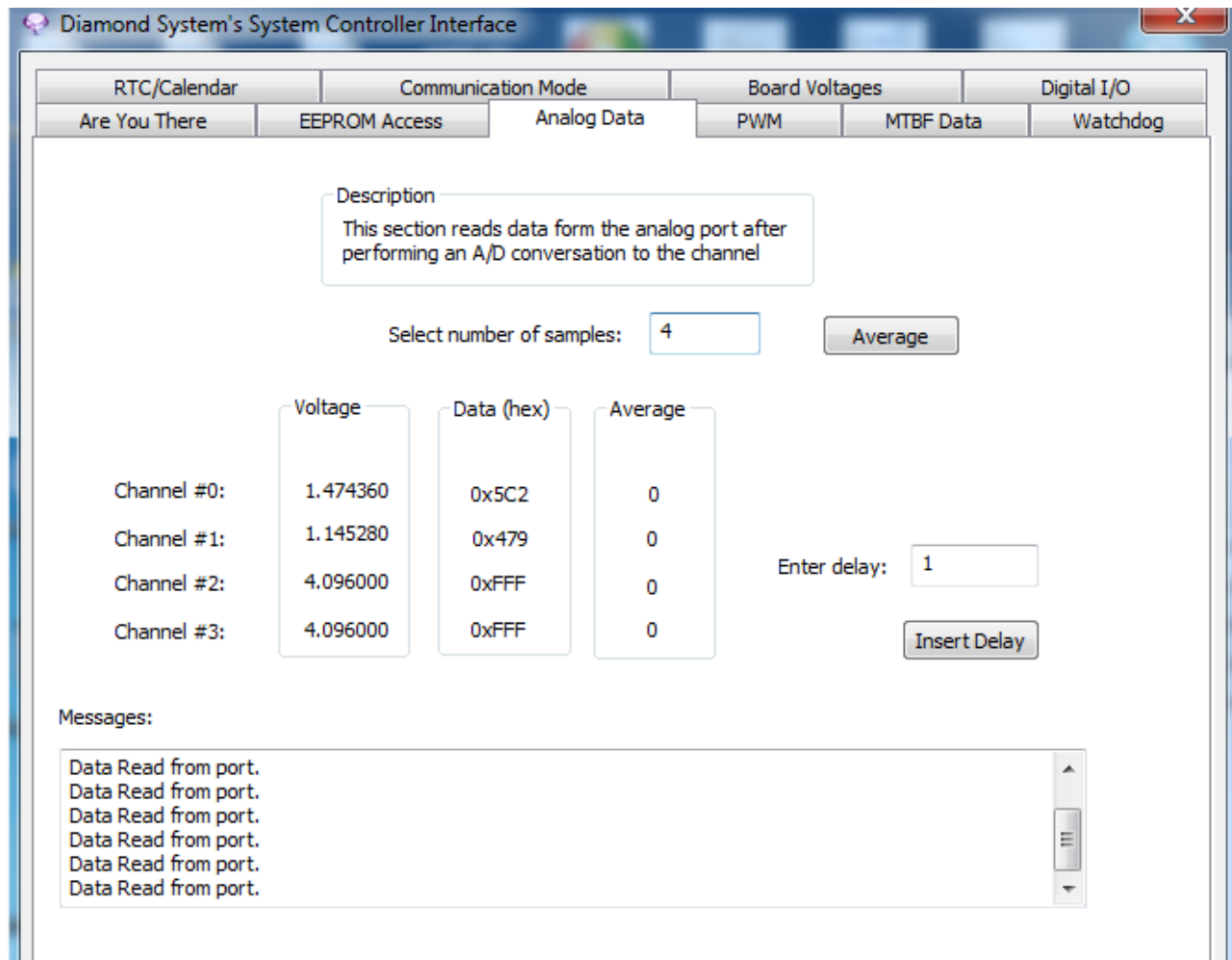
Reading Data...
Data Read.

For writing data to a memory address, enter the address in hex in the text box named "Address" and enter the data in hex in the text box named "Data", then click the "Write EEPROM" button. If the operation is successful then the following message will be displayed in the "Acknowledgement Message" area:

Writing to EEPROM...
Done.

Please note that data can only be written to memory locations in the range 129 to 1024 in decimal value. Any write operation outside this range will not be permitted.

15.6 Analog Data



Diamond System's System Controller Interface

RTC/Calendar | Communication Mode | Board Voltages | Digital I/O

Are You There | EEPROM Access | **Analog Data** | PWM | MTBF Data | Watchdog

Description
This section reads data form the analog port after performing an A/D conversation to the channel

Select number of samples:

	Voltage	Data (hex)	Average
Channel #0:	1.474360	0x5C2	0
Channel #1:	1.145280	0x479	0
Channel #2:	4.096000	0xFFFF	0
Channel #3:	4.096000	0xFFFF	0

Enter delay:

Messages:

Data Read from port.
Data Read from port.
Data Read from port.
Data Read from port.
Data Read from port.
Data Read from port.

Figure 6: Analog Data section

This section reads data from an analog channel at regular intervals and displays the data in Voltage in the "Voltage" column and in hex value in the "Data" column. The interval for successive readings can be set using the "Enter delay" textbox. To set the delay, enter the delay in seconds and then click on the "Insert Delay" button. An average can be done over a number of samples. Enter the number of samples in the "Select number of samples" textbox and then click "Average" button. The average will be displayed in the "Average" column corresponding to the channels. If the system does not have enough samples to calculate the average, then it will show the following message in the "Messages" text area: "Minimum number of samples is not collected".

15.7 MTBF Data

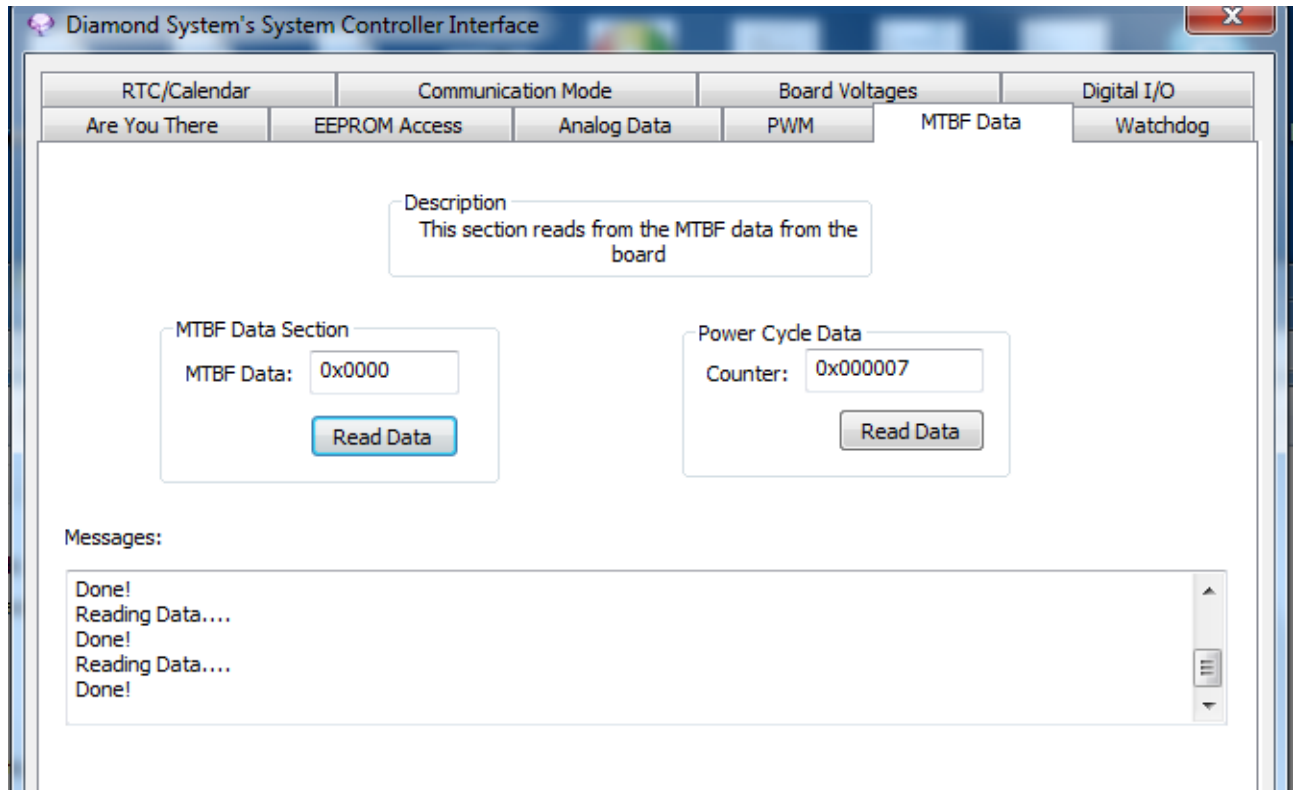


Figure 7: MTBF Data Section

This section contains information regarding start up information. The power cycle data box shows the number of times a reset of the watchdog timer occurred. To get the data click on the “Read Data” the counter data will be displayed in the counter field. The MTBF data section describes time duration to initialize the hardware. Time duration is shown in seconds. For each operation, status will be logged in the bottom section of the window. The user is not allowed to modify the data. The counter cannot be cleared by the user.

For a successful read operation of the MTBF data section, the following message will be displayed in the “Messages” area:

Reading Data...
Done!

For a successful read operation of the Power Cycle Data section, the following message will be displayed in the “Messages” area:

Reading counter data...
Done!

When the firmware is flashed for the first time and there is no watchdog reset and the Power Cycle Data will show an initialization value such as “0xFFFFFFFF”. After the first watchdog timer reset it will show “0x000001” and then it will increment by one for each subsequent watchdog reset.

15.8 Watchdog

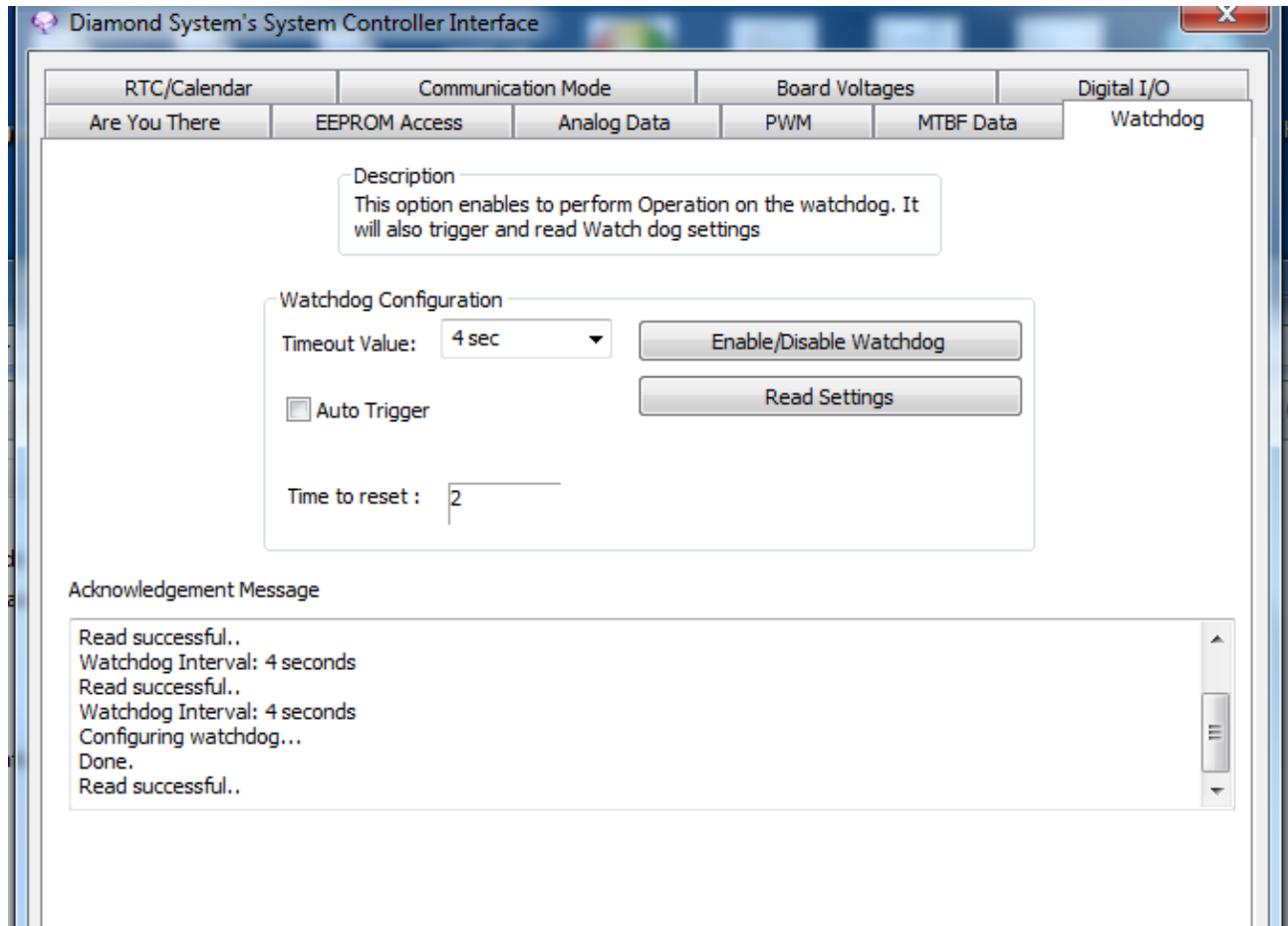


Figure 8: Watchdog section

The watchdog module is used for recovering from firmware errors, for example if the firmware gets stuck while performing an operation. If the watchdog is enabled, it will restart the device after there is a watchdog time out and the device will again start to function. To stop the watchdog restart, the firmware has to clear a flag within a span of time. This operation is called triggering the watchdog. To trigger the watchdog automatically, check the “Auto Trigger” checkbox.

The watchdog timeout value can be set using a value in the Timeout Value drop down menu and then clicking the “Enable/Disable Watchdog” button.

For a successful enable operation, the following message will be displayed in the “Acknowledgement Message” area:

```
Configuring watchdog...
Done.
```

If the “Auto Trigger” checkbox is disabled and the watchdog is enabled, then the timeout value for reset will be shown in the “Time to reset” text box. When it reaches “0”, the board will reset.

To read the present watchdog interval value, click the “Read Settings” button. On a successful read operation, the current timeout interval is displayed on the “Acknowledgement Message” area:

```
Read successful
Watchdog Interval: <interval> seconds
```

Please note that for each watchdog reset, an output pulse will be generated at the RE4 pin.

15.9 PWM

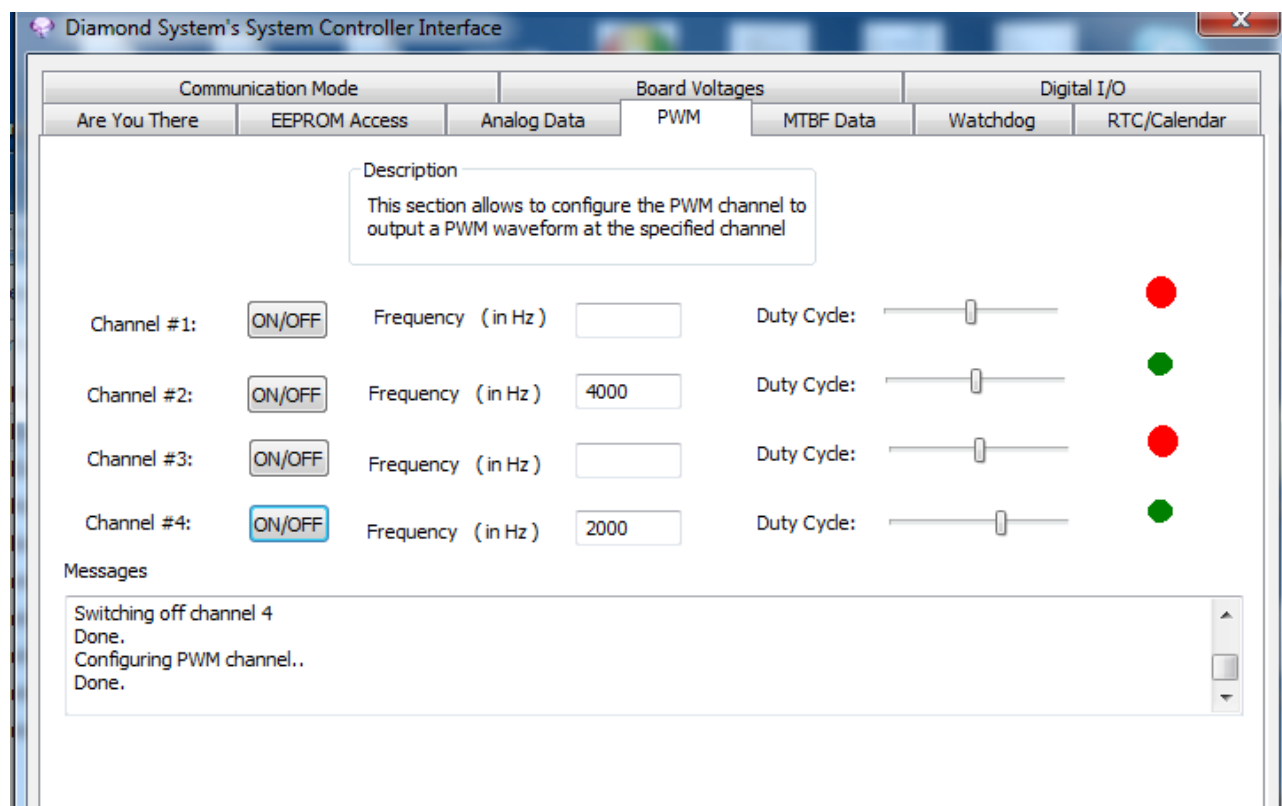


Figure 9: PWM section

The pulse width modulator module (PWM) is used to generate signals with various time periods and frequency.

There are four channels each of which has a textbox for frequency and a track bar for setting the duty cycle. The duty cycle can be changed dynamically by sliding the track bar when the pulse width modulator is enabled. After entering the frequency (in Hz) and duty cycle, click the "ON/OFF" button corresponding to the channel to enable the PWM. If the PWM is already enabled, then clicking the button will disable the PWM. There are four LEDs, one corresponding to each PWM channel, which indicates whether it is enabled or disabled. Green indicates enabled and red indicates disabled. If the PWM cannot be enabled properly due to out of range input values, then it will show the following message:

"Cannot generate PWM at this duty cycle and frequency."

Output pins for different channels are as follows:

Channel #1: P1A/RC2 pin.

Channel #2: P1B/RE6 pin.

Channel #3: P1C/RE5 pin.

Channel #4: P1D/RG4 pin.

Please note that the input frequency must be greater than or equal to 608 Hz. Any frequency input less than this is not permitted.

15.10 RTC/Calendar

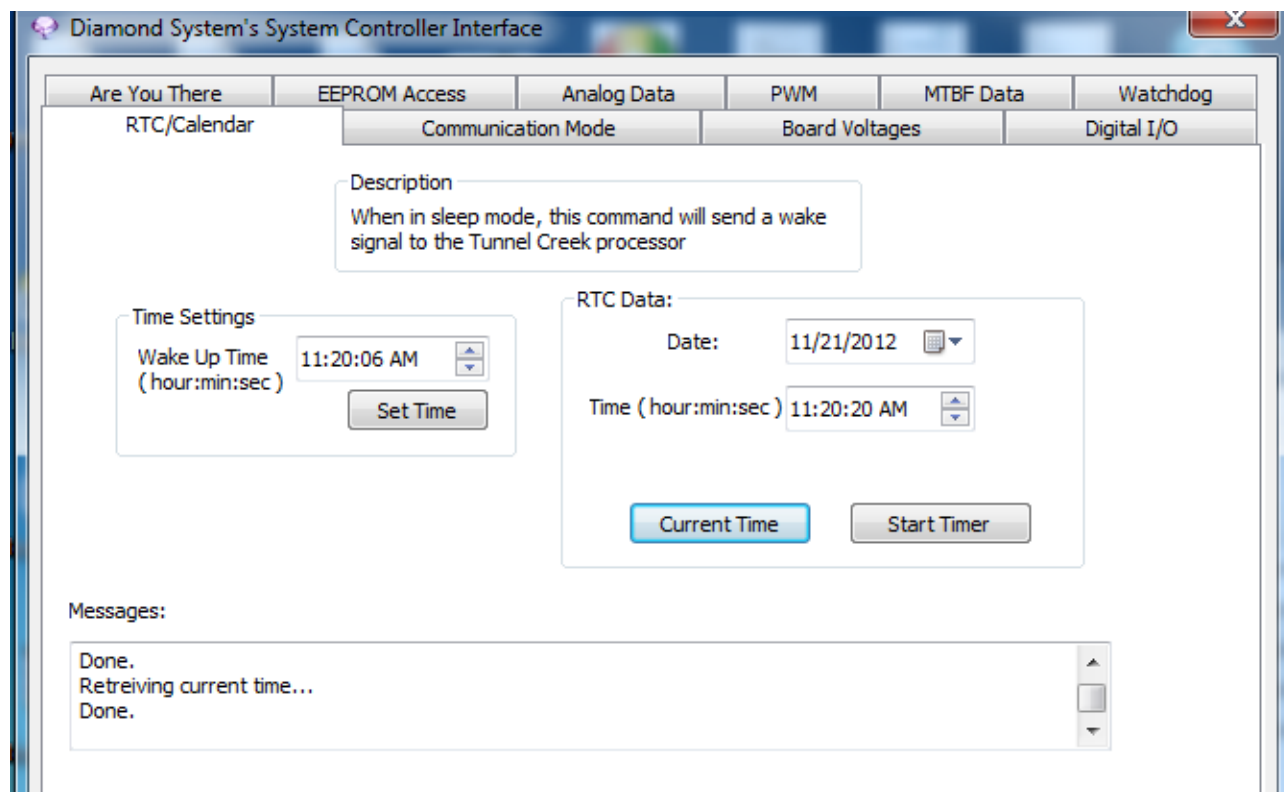


Figure 10: RTC/Calendar section

This module can be used for setting the real time clock of the CPU and also to generate an alarm pulse at a particular time.

The “RTC Data” section consists of Date and Time setting options. The date format is mm/dd/yy and the time format is “hour:min:sec”. Enter a valid date and time and click the “Start Timer” button. This will start the timer. To see the current date and time click the “Current Time” button.

The “Wake Up Time” module consists of setting a time for generating an alarm pulse. The time format is same as mentioned above. Enter a valid time and click “Set Time” button. It will set the alarm and will generate an alarm pulse at the RG4 pin at the specified time. The alarm pulse will be generated only once. For another alarm pulse it should be set again.

15.11 Communication Mode

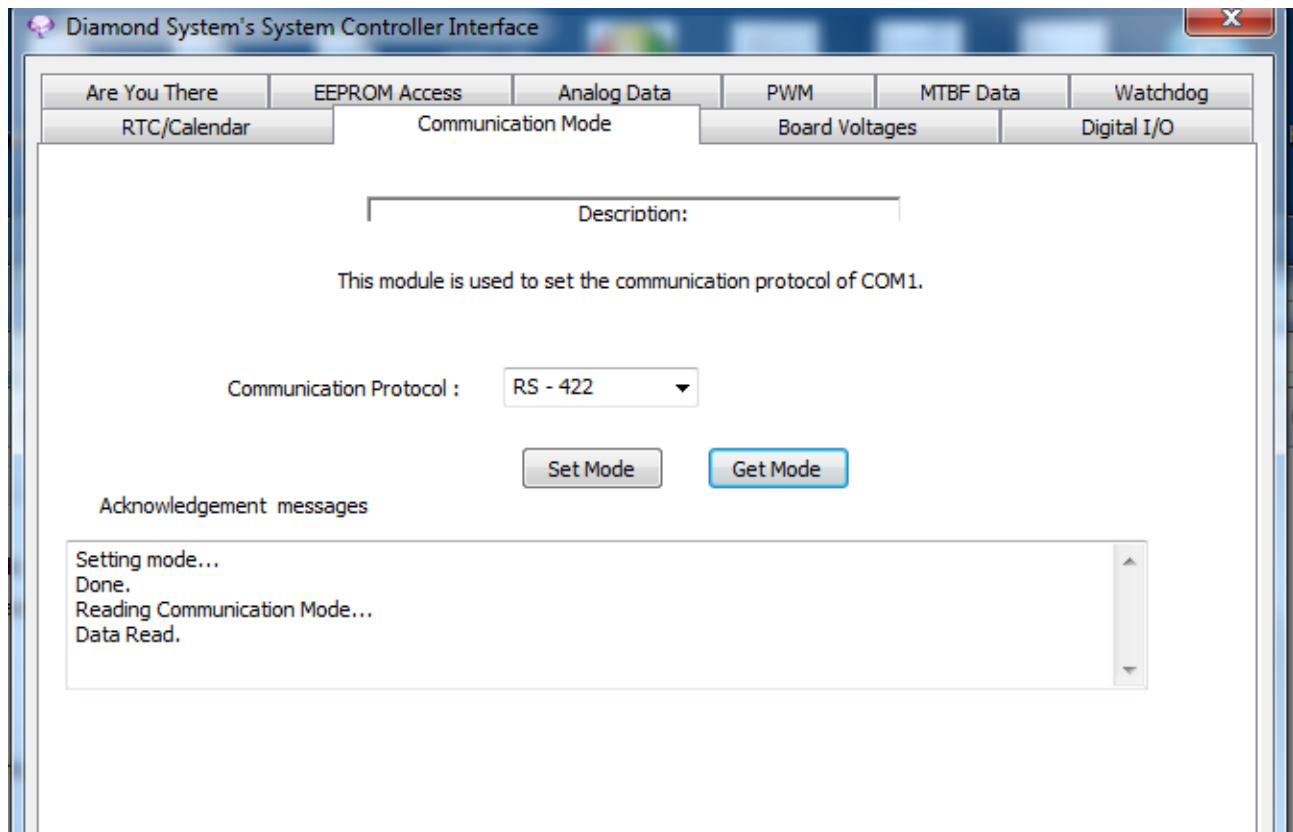


Figure 11: Communication Mode section

This section is used to set a particular communication protocol. Select the mode from the “Communication Mode” combo box and then click on “Set Mode” button to set the communication mode. On a successful operation, the following message will be displayed in the “Acknowledgement messages” area:

Setting mode...
Done.

To get the current mode, click on the “Get Mode” button. It will display the current mode in the “Communication Protocol” drop down box and the following message will be displayed in the “Acknowledgement messages” area:

Reading Communication Mode...
Data Read.

15.12 Board Voltages

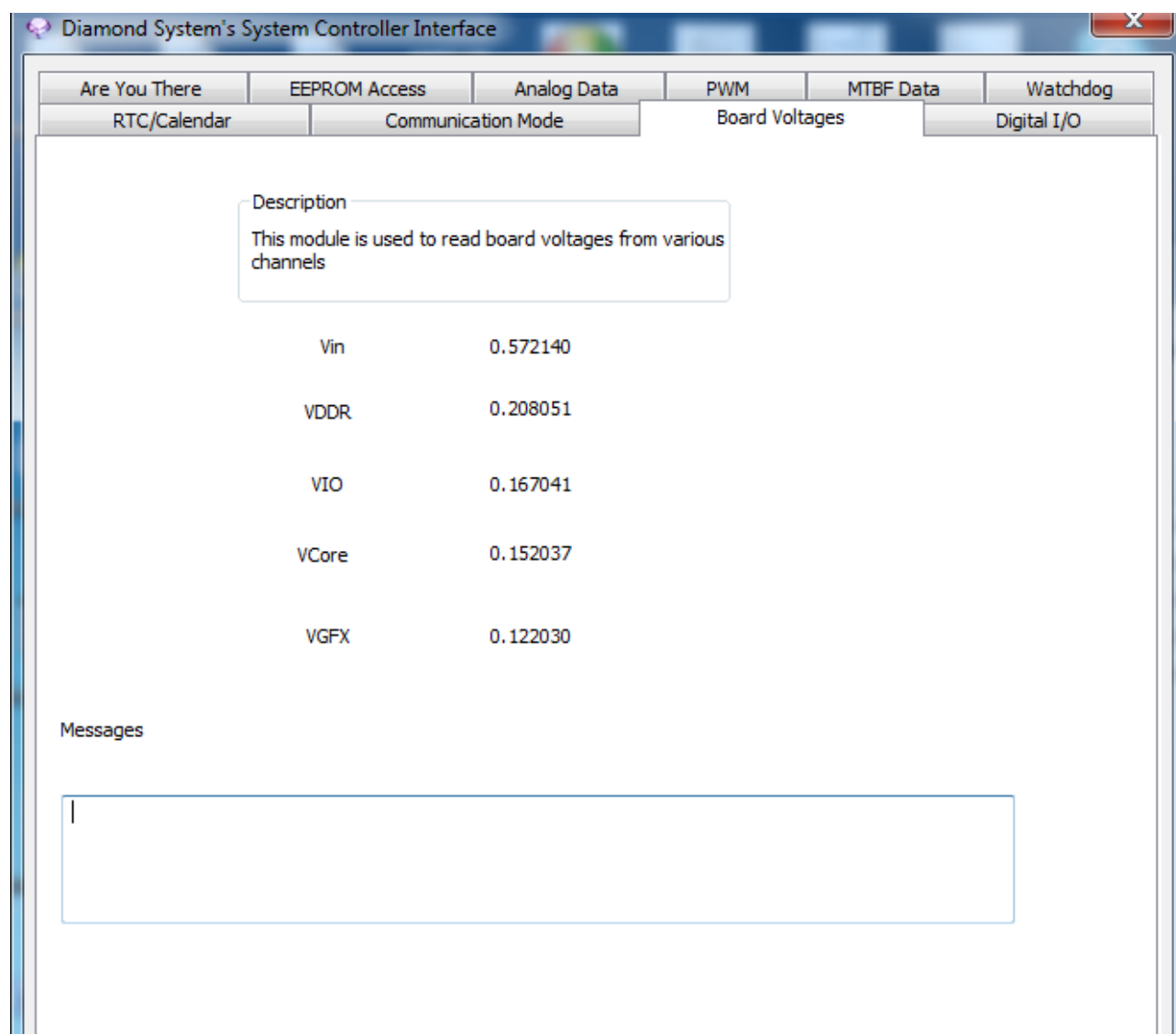


Figure 12: Board Voltages section

This module reads and displays voltages from channel AN6 to AN10 at a regular interval of 2 seconds.

Channel	Voltage
AN6	5V
AN7	Vin (+6 to 32VDC)
AN8	2.5V
AN9	1.5V
AN10	12V

16. I/O CABLES

Diamond Systems offers Cable Kit CK-QUA-01 with cables for all I/O connectors on the board except the LCD and backlight. Some cables are also available separately.



Quantum SBC Cable Kit, CK-QUA-01

<i>Photo Number</i>	<i>Quantity</i>	<i>Cable Part Number</i>	<i>Description</i>	<i>Quantum SBC Connector</i>
1	2	6980500	Dual serial cable	J26, J29
2	1	6980501	Data acquisition cable	J14
3	1	6980502	Gigabit Ethernet cable	J15
4	2	6980503	Dual USB cable	J25, J27
5	1	6980504	USB cable	J19
6	1	6980505	USB client cable	J7
7	1	6980506	Keyboard / mouse cable	J21
8	1	6980507	VGA cable	J9
9	1	6980508	HD audio cable	J17
10	1	6980509	Utility connector	J30
11	1	6980510	Power input cable	J4
12	1	6980511	Battery cable	J1
13	1	6981314	CAN cable	J23

17. SPECIFICATIONS

17.1 Processor Section (All Models)

SBC	
QSeven COM	1GHz AMD Fusion G-T40E
On-board flash	4GB MLC flash
BIOS	AMI PnP Flash BIOS
Cooling	Heat sink
SDRAM memory	2GB 1.3MHz DDR3L SDRAM soldered on board
Display type	18 or /24-bit dual-channel LVDS LCD VGA CRT Display Port
Display resolution	1920 x 1080 maximum
USB ports	5 USB 2.0
Serial ports	COM1 & 2: 2 RS-232/422/485 COM 3: RS-232 fixed
Networking	10/100/1000Mbps Ethernet circuit integrated in the QSeven™ CPU module using Realtek RTL8111E PCIe Gigabit Ethernet controller
Mass storage	1 x Serial ATA port with 600MB/s HDD transfer rate on standard SATA connector mSATA flashdisk socket with 600MB/s HDD transfer rate
Keyboard / mouse	PS/2
Watchdog timer	Programmable
Audio	HD audio CODEC from Realtek ALC262 Stereo line-out, line-in and microphone
Expansion buses	PCI-104 and PCIe/104 stackable expansion 1 PCIe MiniCard socket

Mechanical/Environmental	
System input voltage	+6 to 32VDC ±5% +5VDC ±5%
Power consumption	7.53W idle
Dimensions	4.550" x 3.775" (116 x 96mm)
Weight	7.6oz (215.5g) with heatspreader
MTBF	tbd
Operating temperature	-20°C to +71°C (-4°F to +160°F) (G-T40E model)
Operating humidity	0-90% non-condensing
RoHS	Compliant

17.2 Data Acquisition Section

Analog Inputs	
Number of channels	4 single-ended
Resolution	12-bit
Input ranges	Unipolar: 0-3.3V
Maximum input voltage	+3.3V for linear operation
Digital I/O	
Number of I/O lines	10
Compatibility	3.3V
Input voltage	Low: 0V min, 0.8V max High: 2.0V min, 4.25V max
Input current	+/-10 μ A max
Output voltage	Low: 0.0V min, 0.4V max High: 2.9V min, 3.3V max
Output current	Low: 24mA max High: -24mA max
PWM & Counters	
Number of PWM	4
frequency	608-1200Hz
Counter / timers	2 programmable